GAS JOURNAL, AUGUST 3, 1938

VOL. 223. 90th YEAR. No. 3924.

Editorial Notes

Education in the Industry

THE results of the 1938 Examinations of The Institution of Gas Engineers and the Report of the Board of Examiners, published in the "JOURNAL" for July 20, will have been studied with interest, as also will the questions set in the various examinations, also published in that issue. The results are indicative of the strength of the Institution Education Scheme and the very large and indispensable part it is playing in the training and education of personnel for the Industry. The number of candidates who sat for the examinations this year was 488, of whom 127 failed to satisfy the Examiners; the corresponding numbers for 1937 were 397 and 99. The advance is a satisfactory one. Sixteen Diplomas in Gas Engineering (Manufacture) were awarded, contrasted with five last year, though the Examiners state that the standard reached was rather lower. When we turn to Gas Engineering (Supply), however, we find real cause for disappointment; only three candidates presented themselves and only two awards were made. The reason for this, we suggest, is not hard to seek. It is simply that the Industry does not yet regard the supply side as of anything like the importance of that of the manufacturing side and does not offer supply students the same chances of remunerative posts and the same chances of advancement. This short-sighted policy is retarding the Industry's progress. We have long maintained that the gas supply man needs to be, in his own line, every bit as well trained as the man on the manufacturing side, that he ought not to be behind in his qualifications, remuneration, and status in the Industry. It would appear that the Industry agrees that he should be possessed of equivalent qualifications; its outlook on remuneration and status would not seem encouraging if the number of Supply Diplomas is anything of a guide. This comparison between manufacture and supply is depressing.

Another interesting and, we think, significant figure in the schedule of examination results which appeared on p. 174 of the "JOURNAL" for July 20 is that relating to the Certificate in Gas Supply. Six candidates only presented themselves, five being awarded certificates—two first class, three second class—and the standard of the work "was on the whole disappointing." It will be recalled that at the Institution Research Meeting last autumn it was explained that, to meet the growing need of those not aspiring to a certificate requiring such high academic standards as the Gas Engineering (Supply) Certificate, and those not at present engaged on the practical as distinct from the clerical side of the Industry a new certificate in Gas Supply had been made available. There was some argument at the meeting as to what was meant by "practical" and "clerical," but that is beside the point here. The Gas Supply Certificate does not constitute a qualification for corporate membership of the Institution. On the other hand, the Gas Engineering (Supply) Certificate does; in this respect it now ranks, and rightly, with the Gas Engineering (Manufacture) Certificate. Now the examination in the main subject for the Gas Supply Certificate is identical with that of the Gas Engineering (Supply) Certificate. The difference between the two courses is a matter of the ancillary subjects. The "growing need" for the new certificate is not indicated by the number of candidates responding, and we do query its utility. It is difficult to appreciate just what it offers to those who gain it, and to our mind it would be preferable to encourage those who would take the examination to give a little further thought to the matter and to decide to take the plunge and study for the Gas Engineering (Supply) Certificate, the attainment of which is a qualification for established professional status.

The Gas Supply Certificate would appear to be a sort of halfway house between full technical training in gas supply and the technical training which the ordinary run of gas salesmen require to cope with modern conditions. Is this halfway house necessary or desirable? The Institution is the recognized body for technical education within the Gas Industry; and we put forward the suggestion that the Education Committee might seriously consider some examination of a standard not too high, but adequate for the needs of that vast army of technically trained salesmen of which the Industry stands so greatly in need. To our mind the Institution has the ideal machinery for undertaking such a scheme as we have in mind.

To return to the Report of the Board of Examiners on the 1938 Institution Examinations let us take a glance at one or two of the criticisms they make in regard to the way in which the questions were answered by candidates. In their comments on the Ordinary Grade examinations in both Gas Engineering (Manufacture) and Gas Engineering (Supply) they suggest the advisability of the setting by an outside examiner of one examination paper for the whole country; this, they

argue, would tend to a more uniform estimate of the ability of the candidates. Then for years the Examiners have been asking for greater conciseness in students' replies to the questions and for better sketching and a more liberal use of it. This year we find that "many candidates' answers were too lengthy, often due to a careless reading of the question. . . . Answers should be more concise. . . . Some of the answers submitted were ambiguous and rambling. . . . Candidates still waste time by including unnecessary details." What a familiar ring such statements have. Is there no cure for this rambling, time-wasting way of answering questions? Could not early teaching accomplish much? At any rate the questions set in this year's written examinations in Gas Fitting of the City and Guilds of London Institute constitute an example of what can be done to encourage concise replies; and we agree with the contention of Mr. LeFevre in the Address he gave last year as President of the London and Southern District Junior Gas Association that the length of a candidate's answer can largely be regulated by the method of setting the question.

Research on Coke

RESEARCH, it must be agreed, is essential to the existence of any industry; money spent on the prosecution of research—we are speaking about well-conducted research directed with flexibility—ought to be regarded as an inescapable charge on business. Later in this issue of the "JOURNAL" will be found an extract from the ninth Annual Report of the Northern Coke Research Committee. During its comparatively short existence this Committee has done some quite excellent work and the report is in optimistic vein. It is not so long ago, however, that the Committee was perturbed about possible curtailment in its activities through lessened financial support. Fortunately for the Gas Industry—and more particularly, perhaps, for the coke oven industry, for the majority of problems so far investigated have been specially applicable to the latter industry—a way was found out of the difficulties and the present position is more satisfactory. Even now, though, one can only wonder at the amount and quality of the research accomplished on the limited means at disposal.

Recently a Co-ordinating Committee under the Chairmanship of Dr. F. S. Sinnatt, Director of Fuel Research, was set up, and this has made possible close co-operation between the three Coke Research Committees—the Northern, the Midland, and the Scottish; also, collaboration with the inorganic and physical chemistry laboratories of King's College, Newcastle, has resulted in further fundamental investigations into the nature of carbon. Grants from the Department of Scientific and Industrial Research have enabled the purchase of X-ray equipment, an acquisition which has greatly extended the possible range of the Committee's investigations. An idea of the scope of X-ray investigation was given in the Committee's Report for 1936, referred to in the "JOURNAL" for Sept. 1 last. The basic ideas were set forth thus: "The molecular picture of solid carbon provided by X-ray investigations has shown that such problems as crystallite size, packing, and shape, inter-crystallite adhesion, the accessibility of the interplanar surfaces to various reagents, adsorption effects, the presence of metallic electrons, the presence and *rôle* of chemically bonded hydrogen, oxygen, nitrogen, and sulphur, the relationship of the parent structure of a coke to that of the parent coal, all require further investigation before any clear understanding will be gained of the factors which influence such commercially important properties as coke strength and combustibility."

The present report explains how the micro-strength apparatus devised in the laboratory has been used in investigating the effect of the following factors upon the properties of laboratory prepared cokes: Mechanical pressure during carbonization; rate of heating; size grading of coal; maintenance of the carbonized product at a specified temperature for a given time; addition to coking slack of inert materials such as finely crushed coke and anthracite; addition of pitch; the bonding power of substances such as pitch, shellac, starch, artificial resins, when carbonized with inert carbonaceous materials; the effect of thermal pretreatment on the properties of coal and the coke prepared from it. It has been shown possible to prepare from non-coking bituminous coals, by the application of mechanical pressure during carbonization, cokes which give micro-strength indices of the same order as those of first-class metallurgical cokes, and the pressure required to do this is surprisingly small. Use of the micro-strength apparatus appears to be filling some of the gaps in the quantitative knowledge concerning the factors which govern coke strength.

Each coalfield, of course, presents its own individual problems, and this has naturally led the Committees to attack the problems in their own districts in various ways. Although, however, many problems to be dealt with vary considerably from district to district, certain aspects of the work are common to all three Committees, and the Co-ordinating Committee is dealing effectively with this aspect. The Committee has formulated a programme of research on a national basis which, while making full provision for the study of problems of the individual producing districts, has had full regard for the fundamental aspects that require consideration; and it is necessary that fundamental research should be carried out. There is no doubt, however, that since the formation of the Midland and the Northern Committees in 1926 and the Scottish Committee two years later, the "practical" research undertaken has been of great value not only to the iron and steel industry but also to the makers of coke for the domestic market. The value of this work was well brought out in a report published last year by the Iron and Steel Institute, which was an admirably clear and concise account of the investigations undertaken by the three Committees and indicated how much success can follow co-operative research of this type.

The Employee Shareholder

For more years now than it is cheerful to look back upon, we have been attending meetings of Gas Companies at which there have been present considerable numbers of employees by right of their standing as stockholders. At first, as a novelty, we hailed this new state of affairs with enthusiasm; subsequently, as a custom, we have continued to regard with deep satisfaction this widening of the basis of representation. And we had thought that our appreciation of all that is embraced in the broad-minded policy of which the presence at meetings of these employee shareholders is an outward and visible sign must be general. So we still believe it to be. But it has been borne in upon us that there are exceptions. Writing in the *Evening Standard* a few days ago, Mr. S. W. Alexander said that he has "received some comment from shareholders regarding a question raised at a recent company meeting. The complaint is made—and was actually made at the meeting—that a considerable number of employee shareholders were present, and were participating in the proceedings. It is argued that it is unfair to the outside shareholders that those who have an interest in supporting the Board should participate in the meeting." Well, if there really is any virtue in that sadly over-worked word "co-operation," we feel safe in asserting that the benefits of such participation must far outweigh any possible disadvantages. The opportunities which a number of enterprising

Gas Companies have placed in the way of their employees becoming shareholders have constituted more than a "gesture." They have been a big, a solid, and therefore a well worth while, step in the direction of a better and more endurable understanding between employer and employed. Even should the attendance of employees at a meeting "interfere with their normal work for a company"—the possibility of such a thing happening has been pointed out—this interference might, and we think would, justify itself over and over again. Would that interferences with normal work never extended over greater spaces of time than the hour or two—sometimes even less—required for attending a company meeting and getting a clearer insight into the working of the undertaking with the prosperity of which the employee's welfare is bound up. What is the actual number of days' work lost by labour disputes in the course of a year?

A Much Needed Safeguard

For a long time the "man in the street" must have found himself at a loss to account for the freedom which certain persons known as "sharepushers" enjoyed in plying an undesirable trade, and he must have rejoiced to note that recently quite a number of the fraternity have been successfully brought to book. This, however, has been only after grave harm has been done to people whose outstanding fault has been, in most cases, the harbouring of too great a trust in their fellows. It is always hard to confess to misplaced confidence, though only persons adept in gaining this confidence could hope to succeed in the lucrative occupation of sharepushing. Stupendous sums have been involved in different cases investigated; and while so glittering a harvest remains available there is no reason whatever to doubt that the reapers will be there. Such spoils much be placed beyond their reach. Thus it is that we hail with pleasure the appearance of the text of the Government's Prevention of Fraud (Investments) Bill, which is designed to put a stop to the activities of the undesirable sharepusher, who has been permitted far too long an innings. There are a number of provisions contained in the Bill, but the one which strikes at the root of the evil that the measure is intended to kill is that no person, subject to certain exceptions, will be able to carry on the business of dealing in securities unless he is licensed by the Board of Trade to do so; licences to be valid for only one year. Members of recognized Stock Exchanges, banks and finance houses, approved trustees and managers of authorized Unit Trusts are exempted from the provisions of the Bill. May it soon be placed upon the Statute Book, and prove successful in checking the particular forms of "financial grab" at which it is aimed. Meanwhile, as we have on occasions taken opportunity to point out, an industry such as the Gas Industry, though no Golconda, offers a suitable channel for the investment of the savings of those whose preference is for being safe rather than sorry.

Stoke-on-Trent's Fine Record

At Stoke-on-Trent Mr. A. Mackay has for many years tackled the industrial load in a scientific manner, and by offering gas at attractive rates he has enabled the ceramic industry in his area of supply to enjoy the advantage of a perfect heat service, while playing a most important part in reducing the smoke evil, which is particularly severe in the Potteries. On several occasions in these columns we have called attention to the progress made, and in our news pages last week we were able to bring the story up to date. In his report on the working of the City of Stoke-on-Trent for the year ended March 31 last Mr. Mackay was able to record that in five years the quantity of gas sold for industrial purposes had risen from 224,150,000 cu.ft. to the present figure of 1,171,744,000 cu.ft.—an increase of 442%. The increased demand for ceramic firing was 481,596,100 cu.ft. compared with 369,148,300 cu.ft. for the previous year, and an interesting feature is that five kilns operating on producer gas have been changed over to town gas during the year—indicative of the growing realization among industrialists that fuel cost *per se* is not the guiding factor in determining the cost of the finished product, but that—in the words of Mr. Mackay—"a suitable ceramic fuel giving unvarying combustion characteristics with freedom from spoilage of ware and capable of maintaining a definite quality standard, even at a higher cost in heating value, is ultimately a cheaper firing fuel." Again, the conversion of an oil-fired rotary kiln for frit melting to town gas has proved eminently successful from the point of view of a better product and low production costs. The first decorating kiln fired with town gas was erected and put to work during the year, and Mr. Mackay observed in his report that great advance in the utilization of town gas as a firing medium is anticipated in this direction in the future, since an automatically operated gas kiln giving precision in heat control at a low operating cost has long been required by the pottery manufacturers. Mr. Mackay has gone out for the load with enthusiasm. In addition to offering attractive rates for gas, he has organized for service, having a demonstration and research department where manufacturers can inspect plant and have tests carried out. Now he is reaping the reward for his enterprise and faith in gas.

Personal

The Rochdale Gas Committee have appointed Mr. ERNEST R. NETTLETON as Sales Manager. He succeeds Mr. T. Smith, who has been appointed to a similar position at Derby. Mr. Nettleton was formerly with the Boston Gas Light and Coke Company, where he was Showroom Manager. Prior to holding that post he was Showroom Manager to the Bingley Gas Department.

* * *

Mr. ALEXANDER M'NEIL, son of Mr. A. M'Neil, Works Manager of the Lochgelly Gas Company, has been appointed Superintendent of the Hamilton Corporation Gas Department. Mr. M'Neil gained his experience with Messrs. Henry Balfour, gas engineers, Leven.

* * *

At the annual general meeting of the Worcester New Gas Light Company on July 27, Mr. GEORGE P. MITCHELL, M.Inst.C.E., M.I.Mech.E., Engineer and General Manager to the Company, was unanimously elected to the Board of Directors.

Obituary

The death occurred on July 14 of Mr. C. C. S. FOOKS, a Director of the Gas Light and Coke Company. The late Mr. Fooks was elected to the Board on the amalgamation of the Company with the former Grays and Tilbury Gas Company in 1930.

The funeral took place on Tuesday, July 19, at Horton Kirby, Dartford, and a memorial service was held on the same day at the church of St. Dunstan in the West, Fleet Street.

Forthcoming Engagements

August.

9, 10, and 11.—Irish Association of Gas Managers.—Annual Meeting in Dublin.

[*No meeting of the Central Executive Board of the National Gas Council or of the Central Committee of the Federation of Gas Employers will be held during August.*]

September.

5 to 8.—A.P.L.E.—Annual Conference at Bournemouth.
8.—North British Association.—Annual Meeting at Largs.
15.—S.B.G.I.—Council, 2.30 p.m.
23.—I.G.E.—Joint Lighting Committee, 2.30 p.m.

October

1-4.—B.C.G.A.—Annual General Meeting and Conference at Brighton (for Programme see p. 34 of "JOURNAL" for July 6).
7.—I.G.E.—Joint Committee on Complete Gasification under Pressure, Offices of the Department of Scientific and Industrial Research, 16, Old Queen Street, S.W. 1, 3 p.m.

News of the Week

The Malvern Urban District Council have approved a recommendation of the Gas Committee that application be made for sanction to obtain loans totalling £5,700 for work in connexion with the Gas Undertaking.

The Price of Gas in Lanarkshire is to be reduced by 2d. per 1,000 cu.ft., making the domestic rate 4s. per 1,000 cu.ft. The reduction is made possible by the saving on payment of income-tax on the valuation of the Undertaking, and by various savings on working expenses.

Members of the Chesterfield Gas Committee visited the Hardwick Colliery Company's by-product plant on July 25 and saw the various processes in operation. They paid special attention to machinery recently installed for the supply of coke oven gas to the Corporation.

A Novel Experience was that of Mrs. Annie Greaves, who at the recent première of the new Liverpool housing film, "Homes for Workers," which was screened in the Radiant House theatre at Bold Street, the magnificent new headquarters of the Liverpool Gas Company, with commentary by Mr. L. H. Keay, saw herself "screened" for the first time. Mrs. Greaves lives in one of the new Corporation flats at Myrtle Gardens, and her part in the film was to describe the benefits of such flats in contrast with the old houses they are replacing. By an interesting coincidence, her husband, who accompanied her last night, happens to be an employee of the Corporation Health Department. Her part in the film turned out very successfully.

Newcastle is Showing a Lead by the numbers of householders who have entirely eliminated the use of solid fuel from their homes. Such householders have in the past six months increased by twice their numbers. There is reason for this, as one of the cheapest gas supplies in this country is to be found in this district, and under the Newcastle-upon-Tyne and Gateshead Gas Company's attractive tariff the cost of gas, by fuller use, is reduced to half the initial price, thus competing very favourably with solid fuel. The Company is believed to be the first in the country to bring the scheme before its public by offering specially reduced terms for additional gas appliances to complete conversions. The majority of homes which have been converted to "all-gas" are those of five to six rooms without the aid of a maid. The dearth of domestic servants has assisted in increasing the number of these work-saving homes which use gas in place of solid fuel.

A Contract Has Been Made between the Newcastle-upon-Tyne and Gateshead Gas Company and Messrs. John Bowes & Partners for a supply of gas from the latter's coke ovens at Monkton for the Jarrow Gas-Works. The gas will be delivered through two and a half miles of 12-in. main.

There Was Some Discussion at a meeting of the Walsall Town Council on Monday last as to the relative merits of gas and electricity for public lighting. It arose when a scheme from the Public Works Committee was put forward for street lighting by mercury vapour lamps on all main roads at a capital cost of £5,380, with an annual maintenance charge of £1,655 and total annual charges of £2,125. This followed experiments with mercury vapour and high-pressure gas lamps to test their relative merits. Alderman W. Dean (Chairman of the Gas Committee) moved that the report be referred back, because the Gas Committee had not been given an opportunity of tendering. Mr. H. W. Bonner said they ought to have some thought for the three-quarter million capital locked up in the Gas Undertaking; but in spite of the protests the electrical scheme was adopted.

The Pancake Tossing Competition in the Gas Pavilion at the Empire Exhibition, inaugurated on July 23, continued nightly till July 30, large attendances being attracted each evening. On the closing night, when the finals were judged, no fewer than a thousand persons were crowded into the Pavilion. Mr. Hausdoffer, the eminent chef, acted as judge in the finals and awarded first prize of two guineas to Mrs. Cowan, 23, Nairn Street, Glasgow, second prize of one guinea going to Mr. E. Wilson, 83, Warden Road, Knightswood, Glasgow. A third prize, consisting of a season ticket for the Exhibition, was awarded to Mrs. M. D. Rae, 5, Lawrie Street, Glasgow. Handing over the prizes, Councillor P. J. Dollan, ex-Treasurer of Glasgow, who was accompanied by Mr. A. Bujnowski, sales and publicity officer, Glasgow Gas Department, Mr. W. R. Drummond, of the British Gas Federation, and Mr. David Lawson, organizer of the Exhibition Gas displays, said that gas had certainly played its part at Bellahouston and had won a deserved measure of publicity. Sales at the Glasgow Corporation Gas Stand had also been far in excess of their expectations. He paid a tribute to the fine work of Messrs. Bujnowski, Drummond, and Lawson, and complimented the prizewinners on their success. Mannequin parades are to be inaugurated in the Gas Pavilion on August 8, when a series of displays of kitchen overalls and other wear will be given in the afternoons and evenings.

Amalgamation and Grouping

Gas Consolidation and Churnet Valley.

The Directors of Gas Consolidation, Ltd., announce that their recent offer to the shareholders of Churnet Valley Gas Company, Ltd., has been accepted by holders of a substantial majority of the issued share capital of that Company.

"GAS JOURNAL" Directory

In order that readers may be able to keep the particulars contained in the "JOURNAL" Directory up to date, we summarize in the following list various changes which have occurred during the past month:

Page 8. BOLLINGTON. T. H. Broomhead, E. & M., deceased.
" 50. OSWALDTWISTLE. S. T. Jones appointed E., M., & S.
" 54. RADCLIFFE. Amalgamated with Farnworth and Kearsley Company. J. H. Race becomes E. & M. vice R. B. Braddock, retired.
" 82. DUNBLANE. A. L. M'Lean appointed E. & M. vice E. V. Chalmers, resigned.
" 88. MOTHERWELL. W. Kirk appointed E. & M. vice A. M'Donald, resigned.
" 90. PETERHEAD. E. V. Chalmers appointed E., M., & S. vice W. Ritchie, retired.

Women's Gas Council

Birmingham Branch Visit Stratford-on-Avon.

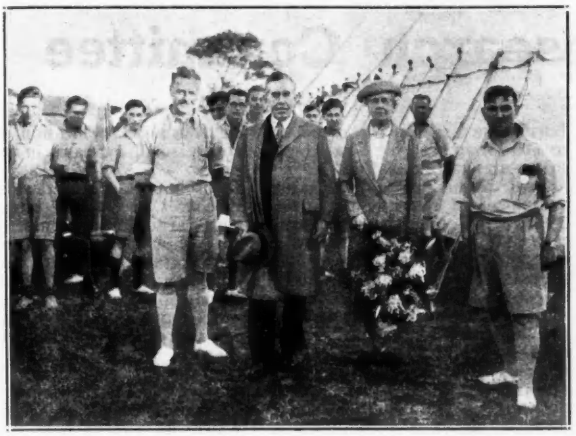
On Wednesday, July 6, 235 members of the Birmingham Branch of the W.G.C. and their friends spent the day at Stratford-on-Avon, the journey being made by coach.

In the morning they visited the Factory of the Stratford-on-Avon Produce Canners, Ltd. The members were welcomed by Mr. J. Joseph and conducted round the works, where they inspected the various processes connected with the canning of fruit; at the conclusion of the tour the visitors were presented with generous gifts of tinned produce. The coaches then proceeded *via* Shottery to the Shakespeare Gallery Café, where luncheon was served, after which the members attended the matinee performance of "Henry the Eighth" at the Shakespeare Memorial Theatre. The party adjourned to the Theatre Café for tea, and there was a free period from 6.0 to 7.15 to enable those who wished to do so to visit various places of interest in the district.

The members left Stratford-on-Avon at 7.30 p.m., returning *via* Alcester and Studley. Mrs. A. S. Giles, wife of the Chairman of the Gas Committee, accompanied the party to the canning factory, and also joined them for luncheon.

A second visit took place a week later, when there was an attendance of 134. The programme was similar to that arranged for July 6, except that the play witnessed at the Memorial Theatre was "Macbeth." The weather on both occasions was favourable.

The G.L.C. Holiday Camp



Sir David and Lady Milne-Watson on a visit to the eighth annual holiday camp of the Gas Light and Coke Company at Clacton.

Teachers of Gas Fitting

Board of Education Course in Birmingham

The second Course for Teachers of Gas Fitting organized by the Board of Education was held in Birmingham from July 4 to 9, most of the activities taking place at the Central Technical College by permission of the Principal and the City Education Committee. Twenty-three teachers from various parts of England were in attendance, a few others being unable to attend owing to illness or pressure of business.

This year the main emphasis was placed on questions of teaching, the organization of classes, and on fitting problems arising from the industrial use of gas. In connexion with the latter, visits were paid to the installations at the British Industries Fair Building, to Smith's Potato Crisps Factory, to the Wolseley Motor Works, and to the Industrial Laboratories of the City of Birmingham Gas Department. The opportunity of inspecting these unusually interesting applications of gas was much appreciated, as was the hospitality extended to the visitors. The practical side was further emphasized by a lecture from Mr. F. L. Atkin on the Installation and Servicing of Industrial Appliances.

The lectures by the Director of the Course (Dr. P. C. L. Thorne, H.M.I.) on teaching methods, by Mr. J. H. Currie, of the L.C.C. Staff, on methods in the workshop, by Mr. C. H. Creasey, O.B.E., on the functions of school and daily work in the training of the craftsman, all served to direct attention to the art and science of teaching. Mr. S. B. Watkins, of the Treforest School of Mines, discussed the use of the blackboard and of other illustrative matter. This talk was supplemented by some hours of actual practice on blackboards with obviously beneficial effects on this branch of the work. A number of lecture demonstrations in Physics by Mr. H. Orwin, of the Central Technical College, indicated how important scientific principles applicable to the craft might be illustrated by simple experiments and were much appreciated. Mr. W. L. S. Spinks, of the City of Birmingham Gas Department, gave an interesting account of the methods of training of gas fitters in use in that City.

One important feature of the Course was the discussion on the proposed new syllabus of the City and Guilds Institute, at which the Examiners in Gas Fitting were present, Mr. F. C. Briggs, Vice-Chairman of the Gas Education Committee of The Institution of Gas Engineers, taking the Chair.

Members of the Course coming from a distance again had the pleasure of staying at Saltley College, where every arrangement was made for their comfort. At an informal dinner held on Wednesday, July 6, a number of important guests were present, including representatives of the Board of Education, The Institution of Gas Engineers, the City and Guilds Institute, and the City of Birmingham Gas Department.

At the end of the Course, the members, somewhat tired by the unusual type of exertion which had been demanded of them, held the usual discussion on the value of the Course. Apart from minor suggestions for improvement, the verdict was entirely favourable. It is to be hoped that in future years undertakings will do everything in their power to encourage those members of their Staffs who are engaged in teaching Gas Fitting to attend these Courses, for without a supply of able teachers the training of fitters is likely to languish.

Electricity Failure at Coventry

Widespread Disorganization

The greatest electricity breakdown in the history of Coventry occurred early on the afternoon of July 27, when the Longford generating station was completely put out of action, and the whole of the city and the large area outside the boundaries which is supplied with electricity from Coventry were without electric light or power for some considerable time.

The breakdown occurred at about twenty minutes past one, and the great motor car and engineering factories all over the city were brought to a standstill. Offices were without light, and every sort of building in the city was affected in one way or another. Housewives engaged in ironing and other domestic occupations had to stop work, and wireless sets in the city were silenced.

At 3 o'clock engineers were still working on the switchboards at Longford, endeavouring to trace the cause of the breakdown. At that time some districts had their supply restored, but many areas were still without current. Tramway routes ceased to function, and for some time chaos was inevitable.

In the centre of the city the breakdown lasted about half-an-hour.

The Standard Motor Company, Ltd., kept men standing by idle until about 2.30 p.m., and then, as the current did not come on, they shut down the works for the afternoon. An official stated that it was a very long time since production had been so seriously dislocated. At the Alvis Motor factory it was stated that the men had been kept idle for a short time after their return to work from their lunch hour, and that production was later resumed. Workmen at the Daimler Motor and Aero Engine factory lost between a quarter of an hour to 20 minutes' work while they waited for the current to be switched on again.

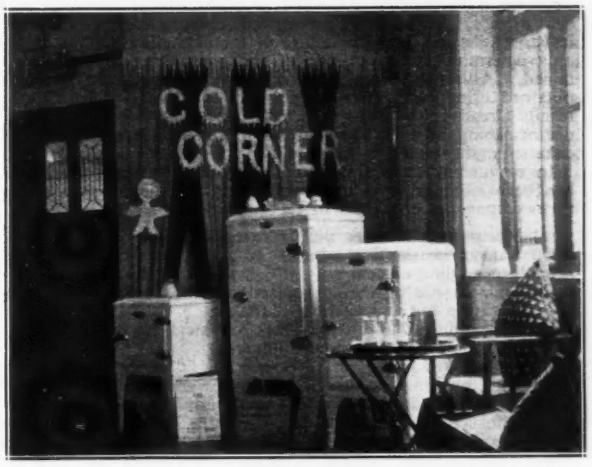
Another factory to stop work for the day was that of the Coventry Swaging Company.

An official of the Coventry Corporation Transport Department said that trams on all routes were stopped in their tracks at about 20 minutes past one. The trams stood on various routes until nearly 10 minutes to two, before the current enabled them to restart.

Later in the afternoon it was stated that the factories of Messrs. Courtaulds, the G.E.C., and the Humber Motor Company were still idle, although employees were standing by.

At the Coventry and Warwickshire Hospital little inconvenience was caused, although the institution was without light or power for nearly half an hour. Lights in the operating theatre went out, but no operations were being performed at the time. Serving the theatre is a small auxiliary plant, but it was not necessary to bring this into use.

A Cool Corner in Sussex



An excellent way of drawing attention to the advantages of gas refrigeration has been devised by the Haywards Heath District Gas Company. The Managing Director and Secretary, Mr. Alec. E. Whitcher, M.I.Mech.E., writes to say that a corner of their showrooms has been set apart for the serving of ices and iced drinks during the time that consumers are settling their June quarterly accounts.

Work of the Northern Coke Research Committee

Report for 1937

The Northern Coke Research Committee held three meetings during 1937, and two progress reports and a memorandum on the application of X-rays to the study of the solid state were issued. The close co-operation between the three Coke Research Committees, made possible by the establishment of the Coke Co-ordinating Committee under the chairmanship of Dr. F. S. Sinnatt, F.R.S., Director of Fuel Research, has been continued. Collaboration with the Inorganic and Physical Chemistry Laboratories of King's College, Newcastle, has made possible further fundamental investigations into the nature of solid carbon.

Generous grants received from the Department of Scientific and Industrial Research and from the Research Committee of King's College made possible the purchase of X-ray equipment which was installed in the latter half of the year. This acquisition has extended greatly the possible range of the Committee's investigations. Dr. A. Taylor has joined the staff of the laboratory to assist with this work.

The following gives a brief outline of the more important aspects of the investigations carried out during the year.

Coke Formation.

The qualitative nature of many of the factors which play a part, during carbonization, in determining the properties of a coke, is well known. Much quantitative knowledge is, however, still required before it will be possible to replace by exact scientific methods the empirical methods now adopted in blending and carbonizing practice generally. An attempt has been made during the past year to fill in some of the gaps in the quantitative knowledge concerning the factors which govern coke strength. This has been made possible by the use of the new micro-strength apparatus, devised in the laboratory. Preliminary experiments showed that the micro-strength indices obtained with this apparatus bore no simple relationship to either the shatter or abrasion indices obtained with lump coke. Further experiments on laboratory prepared cokes brought to light a remarkably close parallelism between the micro-strength indices and other physical and chemical properties, such as electrical conductivity, porosity, wet oxidation rate, and contraction during carbonization. The reason for this is obvious. When lump coke is employed in a strength test the index obtained is largely determined by the incipient fissuring in the lumps of coke and therefore a coke which is intrinsically strong may give low shatter and abrasion indices, particularly if excessive contraction has occurred during the final stages of carbonization. When, however, the sample of coke employed is small (*e.g.*, sized between 14 and 25 B.S.I. sieves as in the micro-strength tests) no fissures remain and the index obtained is determined largely by the strength of the coke substance itself. Such factors as cell-wall thickness, crystallite packing and adhesion, and the nature of the crystallite surfaces probably determine the magnitude of the micro-strength indices obtained. Although from a practical standpoint the strength obtained using lump coke is probably of more significance, the results already obtained demonstrate conclusively the necessity of distinguishing between these factors in any fundamental study of coke strength.

In conjunction with other tests, the micro-strength apparatus has been used in investigations of the effect of the following factors upon the properties of laboratory prepared cokes:

(*a*) Mechanical pressure during carbonization.
(*b*) Rate of heating.
(*c*) Size grading of coal.
(*d*) Maintenance of the carbonized product at a specified temperature for a given time ("soaking").
(*e*) The addition to coking slack of inert materials such as finely crushed coke and anthracite.
(*f*) Addition of pitch.
(*g*) The bonding power of substances such as pitch, shellac, starch, artificial resins, when carbonized with inert carbonaceous materials.
(*h*) The effect of thermal pretreatment on the properties of coal and the coke prepared from it.

The coals employed in these tests were Northumberland "non-coking" and poorly coking coals, South Wales steam and coking coals, and certain Durham coals. The following are the more important results of this work.

It is possible to prepare from "non-coking" bituminous coals, by the application of mechanical pressure during carbonization, cokes which give micro-strength indices of the same order as those of first-class metallurgical cokes. The pressure required to do this is surprisingly small, being of the order of 20-40 lb./sq.in. Further increases in the pressure applied during carbonization up to 500 lb./sq.in. bring about only relatively small increases in the micro-strength indices.

Two distinct temperature ranges are of importance in the development of strength in the resulting coke. In the first range, 350-550° C., the strength increases with carbonization temperature and is greatly influenced by the pressure applied during carbonization. After a short temperature range in which the strength remains approximately constant, from 650° C. upwards the strength again increases with carbonization temperature, but the increase is quite independent of the applied pressure. The first temperature range is that in which the process of chemical condensation is taking place, and in the case of a coking coal it represents the temperature range in which the coal passes through a plastic condition. This result emphasizes very clearly the importance of the conditions prevailing as a coking coal passes through the plastic condition, a fact which has already been emphasized by other workers, particularly by Foxwell in this country.

The increase in strength which occurs in the second temperature range begins at that temperature at which the coke loses its insulating properties and attains an appreciable electrical conductivity. This fact is of fundamental significance, for it indicates that at approximately 650° C. new cohesive forces come into play, due to the liberation of metallic electrons. These new forces are probably also responsible for the contraction and consequent fissuring which occurs as the carbonization temperature increases above 650° C.

Another result of considerable practical importance has been obtained in these studies, in the case of a poorly coking Northumberland coal. As the pressure applied during carbonization was increased the micro-strength index passed through a maximum, the actual position of which depended upon the size grading of the coal employed and was between 10 and 15 lb./sq.in. The behaviour of the coals during carbonization and the appearance of the cokes indicated that this phenomenon was connected with the entrapping of gaseous products during carbonization and consequent pore formation.

Cokes prepared from finely ground coals gave cokes having micro-strength indices greater than those from coarser coals. The effects of variation in rate of heating from 1-5°/min. and of soaking upon the micro-strength index were relatively small and varied with different coals. It is probable that the effect of these variables is greater when coking coals are carbonized under conditions differing from those employed in the investigation. Further study of these factors is in progress.

Carbonization of mixtures of coking coals and coke fines gave cokes whose micro-strength indices decreased linearly with the percentage of coke fines added.

A study has also been commenced of the effect of moisture upon coal strength and some interesting results have already been obtained.

Carbon Combustion.

Studies of carbon combustion have been continued by several different methods. The investigation of the "wet oxidation" of carbon has been extended to active carbons. The study of the anodic oxidation of various types of carbon in different electrolytes has already yielded interesting results. Experiments on the combustion of carbon in oxygen at low pressures and in atomic oxygen have been initiated. The latter experiments are being carried out with the help of Dr. P. L. Robinson (King's College). It is hoped by these experiments to throw further light on the complex mechanism of carbon combustion.

A comparison of the relative rates of oxidation of representative carbons by solutions of potassium dichromate in strong phosphoric acid and in different strengths of sulphuric acid has been made. Solutions of potassium dichromate in sulphuric acids of various concentrations oxidized the carbons more readily than did the corresponding phosphoric acid solution and exhibited a maximum oxidation rate at a particular strength of sulphuric acid. The concentration of the sulphuric acid corresponding to the maximum oxidation rate was different for different carbons. The use of phosphoric acid (d.1·75) solutions of potassium dichromate was shown to be preferable for the purpose of routine tests. Reactivation of active carbons increased their rates of oxidation in sulphuric acid solutions of potassium dichromate, a result which was in keeping with the views of Berl and others on the nature of active carbons. During combustion in the blast furnace the coke must pass through an "active" condition, so that any new light which can be thrown on the properties of active carbon may be of importance in fuel technology.

Gas in the Service of Cremation

by

G. le B. DIAMOND, M.I.Mech.E., M.Inst.Gas E.
(Engineer and General Manager, Folkestone Gas and Coke Company),

and

T. V. GARRUD, Assoc.M.Inst.Gas E.
(Chief Industrial Representative, Gas Light and Coke Company).

[From a Paper read before the Cremation Conference, July 25.]

Introduction.

In presenting this Paper to the members of the Oxford Cremation Conference, 1938, the Authors desire to express their appreciation of the invitation extended to them to place before the Conference the latest information on the technique of cremation. They would also like to refer to an earlier contribution given before the Folkestone Conference in 1935 wherein they traced the history and development of the gas-fired cremation furnace to that date.

Since then progress has continued on the technical side, and increasing attention has been given to the æsthetic side of cremation, whereby heated air only is utilized in the incinerating chamber for all average cases, thus removing the objection felt by some to the operation of the earlier types of furnace. Moreover, although the furnace rooms are not usually open to lay members of the public, yet it is realized that from time to time official committees and others visit them for inspection purposes. It has therefore been deemed advisable for furnace design to be improved so that outwardly they will harmonize with the architectural features and be in keeping with the dignity of their solemn purpose.

The progress of the Cremation Movement has been more rapid during the past two or three years than at any time before in its history. The educational work of the Cremation Society and others is steadily having its effect, and never was the time more opportune, for in this modern age old customs are being continually reviewed and revised. It is astonishing to reflect upon the changes which have already taken place with regard to the practices and customs associated with the disposition of the dead. It appears that the Gas Industry is destined to play an even larger part in providing the Movement with a swift, clean, hygienic, and æsthetic means of disposal, for in the British Isles already there are forty-one crematoria and gas provides the medium for resolution in no fewer than thirty-three. Abroad also there is an ever-increasing use made of gaseous heat, and many of the old-established crematoria are being converted from solid fuel firing to gas heating.

Present Practice in Furnace Design.

Since the 1935 Paper, progress has continued on typically British lines. It was not anticipated that maintenance or running costs could be materially improved; therefore attention has been given principally to improvements in technical operation—the application of heat and the provision of recuperation for heating the air required for oxidation. Moreover, the outward design of furnace casing has been greatly improved in appearance, and furnaces can be provided to meet any required condition—for example, with open grid hearth, or with closed hearth and auxiliary incinerating chamber for completing the cremation, with recuperators where fans are available, or with natural draught burners in districts where fans cannot readily be provided. All are characterized by ease of operation and can be operated by any man of average intelligence.

Much thought has been given to the æsthetic side of cremation and the disposal is now effected by means of heat with air gently applied. While every attention has been given to meeting the requirements of the idealist, the economic side has not been overlooked, and fuel costs are kept within reasonable limits. The time required for a complete cremation with gas-heated furnaces varies within quite narrow limits, about 1¼ to 1½ hours being typical. This figure gives good service and allows the undertaker, who often travels some distance, to return with the ashes if so desired. In addition, it allows funerals to follow one another in reasonable succession, and relieves the superintendent of the anxiety which otherwise must ensue if he is equipped with a slow incinerator.

Askam Natural Draught Furnace.

This furnace first appeared in 1923 and there are a number in operation in various parts of the country, giving efficient and satisfactory results. It is particularly suitable for installation in places where the provision of a fan is out of the question for the burners are arranged to operate on town gas at normal pressure.

The outer casing can be provided in any form to suit the surroundings and has sometimes been finished in white glazed bricks. The interior is lined with the best Scotch refractories, noted for their long life and hard service, while suitable insulation is also included. It is usual with this type of furnace to operate with the open grid hearth, fitted with a combustion zone in the ash chamber beneath, the heat from which rises into the incinerating chamber, the burners giving a perfectly clean flame.

Askam Air Pressure Cremating Furnace.

This incinerating furnace has been designed to operate on town gas at normal pressure, but the burners are so positioned that combustion takes place in a downward direction against the furnace walls which are rapidly heated (fig. 1). The hot waste products are drawn upwards to a secondary chamber which incorporates the recuperator. Air from a turbo blower is passed through the recuperator and blown downwards from the centre of the arch, causing intense oxidation. This arrangement serves also to eliminate any smoke that otherwise might be given off.

It is well known that wide differences exist between human bodies from the cremationist's point of view, and cases vary so much that individual attention has normally to be given to each cremation. It has been stated by one Authority (Magistratsoberbaurat Fr. Hellwig, Berlin) that of one hundred bodies, sixty-five are normal and cremate with little or no heat supply, other than the wood of the coffin and the oxidizable parts of the body; twenty-five cremate indifferently and require some application of heat during incineration, while ten require the continual application of heat. The Authors referred to the latter difficulty in the 1935 Paper with particular reference to those cases where death had resulted as the outcome of a long and wasting disease.

The furnace described is adaptable over a wide range of cases such as these, and is particularly economical in fuel costs and maintenance.

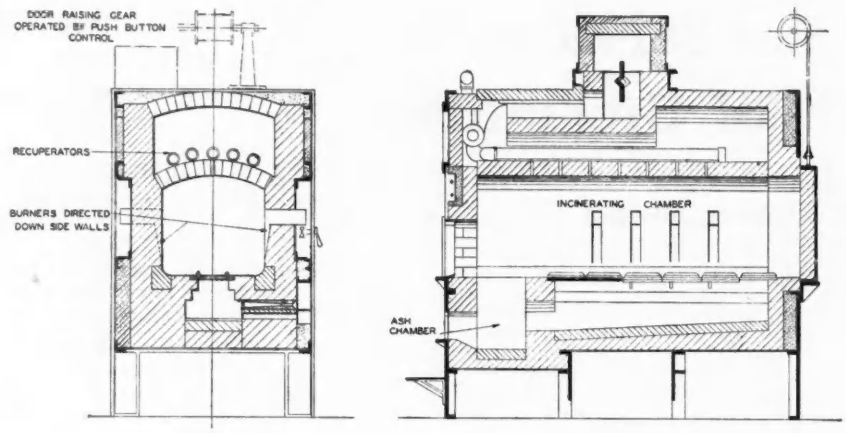
In most cases, incineration can be carried out in a hot furnace with the aid of pre-heated air from the recuperator only, while, in the event of interruption of the supply of power to the turbo blower, cremation can be completed by the use of natural draught burners provided as an auxiliary for such emergencies.

A special feature of this furnace consists in the provision of a secondary ash chamber at one end of the furnace to which the ashes can be transferred for the final oxidation. This not only results in efficient operation but the final ash is rendered very white and free from carbon.

The furnaces at Golders Green were supplied by Askam to the design of the London Cremation Company. An illustration of this installation is given in fig. 2.

Radiant Heat Cremating Furnace.

The Radiant Heating Company, Ltd., of London, have recently completed the installation of two of their patent furnaces at Putney Vale. [A description of this plant was given in the "JOURNAL" for July 13.] It will be seen from



ASKAM AIR PRESSURE CREMATING FURNACE

Fig. 1.

the illustration fig. 3 that the heating elements are fitted in the side walls of the incinerating chamber and in the chamber beneath. Their design and construction are of sufficient interest to warrant detailed description. Each unit consists of a specially moulded fireclay block, fitted with a number of china clay tubes each 3 in. long. The total thickness of the block is 5 in., so that in its depth there is 3 in. of tube and 2 in. of fireclay tunnel (fig. 4). Moreover, each tube is provided with seven holes less than $\frac{1}{16}$ in. in diameter. Combustion of the gas takes place within the tunnel without flame so that the whole surface of each unit becomes incandescent. This is a development of the earlier porous combustor made by the same Company and has the advantage of greater mechanical strength. Cremation is carried out by radiant heat, there being an entire absence of gaseous flame from the fuel at any time within the incinerating chambers.

The spent products are utilized for heating the secondary air required for oxidation, and for this purpose there is a battery of heat-resisting tubes situated in the upper part of the furnace, through which air from a fan passes to be directed through ports in the arch of the furnace on to the coffin.

The Putney Vale installation is quite a new departure in cremation halls, for not only does the architectural treatment differ from previously conceived ideas, but the furnaces themselves are provided with cream-coloured vitreous enamelled outer casings and chromium plated fittings, the whole being functional and based upon hospital practice.

An external view of this furnace can be seen in fig. 5.

Rogutt Cremating Furnace.

The Authors referred in the 1935 Paper to a previous installation designed by Messrs. Utting & Rogers at the Arnos Vale Cemetery, Bristol, and once again these ingenious technicians have set to work and produced another cremating furnace (fig. 6). It is of somewhat similar design to the earlier incinerator, but the whole structure is enveloped in a planished steel case which also encloses the counter-balance gear, supply pipes, &c. Gas and air controls are fitted on a

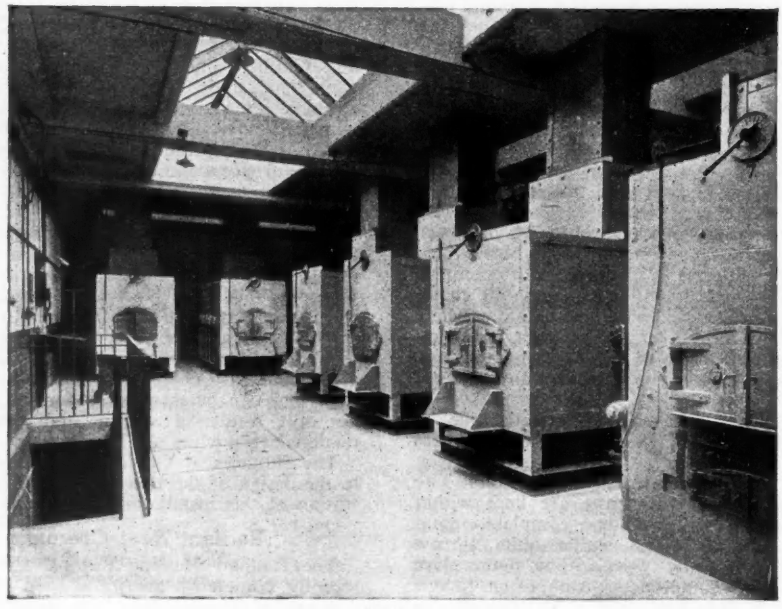
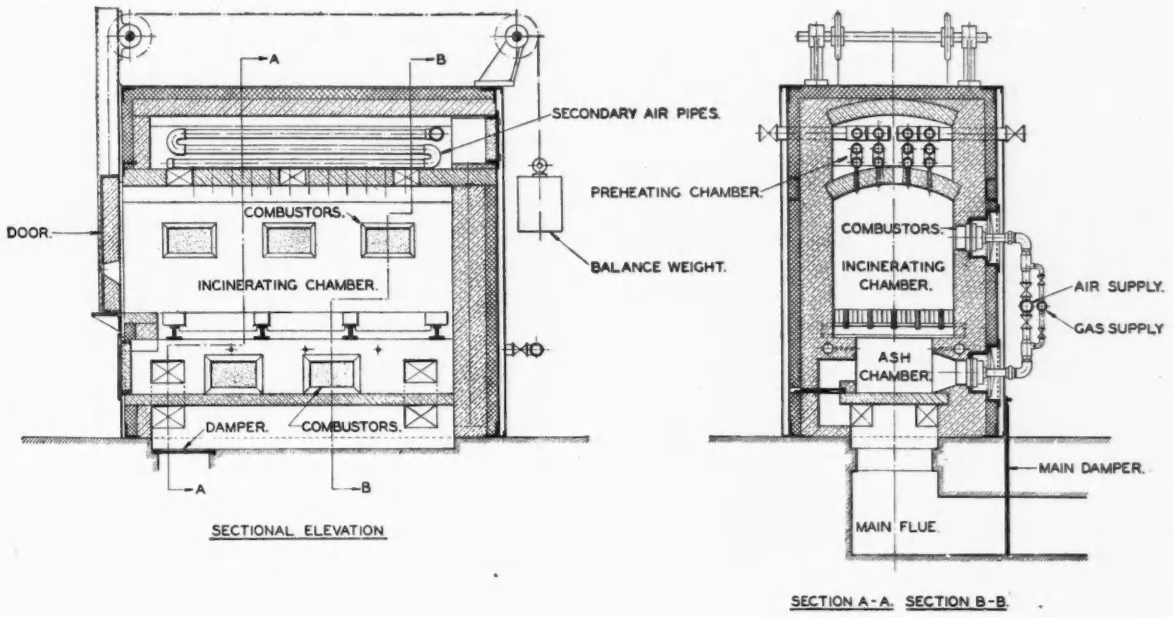


Fig.2.



RADIANT HEAT CREMATORIUM FURNACE.

Fig. 3.

neat panel, together with the gauges indicating gas and air pressure.

The burners are of the pressure-gas/pressure-air type, with separate control of both gas and air. The upper and lower portions of the incinerating chamber are provided with secondary air inlets, the air being induced by flue pull and caused to pass between the furnace wall and the insulating brickwork. The effect of this is to reduce the surface temperature of the exterior and at the same time provide some pre-heating of the secondary air, the flow of which is conveniently controlled from the panel at the front of the furnace.

Notes on Operation.

Some gas consumption figures obtained recently will be of interest for they show that economy in operation can be achieved without continuous working. As an example, figures obtained at the St. Marylebone Borough Crematorium show that the first fifteen cremations in a newly installed furnace, with the usual moisture content in the brickwork, were carried out with an average of nine therms per cremation, the time being 1¾ hours—the second fifteen cremations required four-and-a-half therms and 1½ hours per cremation, while for the third fifteen cremations the figures were reduced to the low average of three-and-a-half therms of gas and 1½ hours per cremation. The cost of gas in various parts of the country varies, but if the price is assumed at from 6d. to 9d. per therm for this purpose, it will be seen that the fuel cost per cremation with a modern gas-heated furnace is as low as 1s. 9d. to 2s. 7½d., and carried out under conditions in all respects ideal. These figures have been kindly provided and are introduced by the courtesy of Mr. A. H. Lawrence, the Superintendent. Fig. 7 shows the furnaces, which are the latest Askam air pressure incinerators.

For the following results at Golders Green the Authors are indebted to the London Cremation Company:

Period.	Number of Cremations.	Average Gas Consumption per Cremation.
		Therms.
Year ended Feb. 22, 1936	2,924	4·5
„ „ Feb. 20, 1937	3,189	3·3
„ „ Feb. 19, 1938	3,129	3·6

The average time per cremation for the past twelve months was eighty-five minutes, and the average cost for furnace repairs amounted to 3½d. per case.

At the Woking Crematorium, substantially similar results to the foregoing have been recorded and are reproduced by the kind permission of Mr. H. T. Herring. For the year ended Oct. 31, 1937, 509 cremations were carried out there at an average of 4·5 therms per cremation, while no furnace repairs have been undertaken since the installation was completed eighteen months ago.

The figures in regard to Streatham Park Crematorium for the year ended April 30, 1938, were 788 cremations, and the gas consumption 350,390 cu.ft., giving the astonishingly low average of 2·2 therms per case.

Progress Abroad.

It is always of interest to compare the technical information which is available on any scientific subject in different

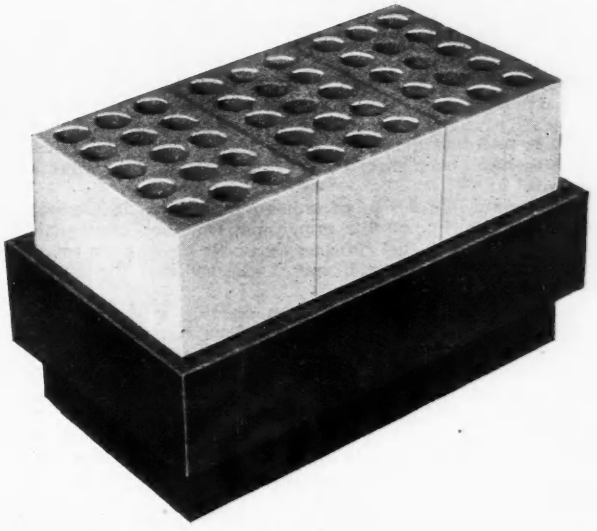


Fig. 4.

countries, but it is particularly appropriate to do so at this Conference, for only last September at the International Congress held in London, there was formed an International Crematoria Federation.

The objects of the Federation are, of course, to study the Movement from an international point of view and, in this

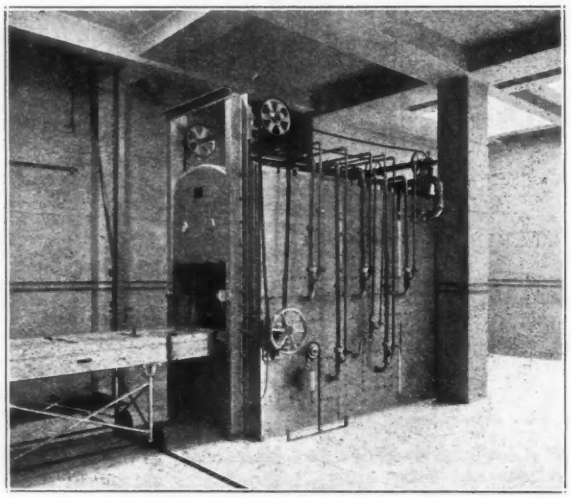


Fig. 5.

connexion, the Authors submit these notes, very far from exhaustive, on the trend of technical progress in Europe and America.

Europe.

Germany.

In the number of cremations carried out annually, Germany leads the world, for during the past five years the figures have crept up from 60,000 to 80,000 per annum. There are about 120 crematoria, in the great majority of which gas is used. There are two electrically heated furnaces at present, one at Erfurt and the other at Essen. As originally planned most of the German crematoria had coke-fired furnaces but these have gradually been converted or replaced by the gas heated ones. For instance at the Treptow Crematorium, Berlin, the obsolete coke-fired plant dating from 1913 was replaced in 1928 with two furnaces designed for gas and coke firing, but since then both furnaces have been converted to gas heating and a third since added has been equipped for gas heating only.

In Berlin alone in three Crematoria no fewer than 19,800 cremations took place in 1937, an average of 380 per week, while in London during the same year at six Crematoria, 5,000 cases were dealt with, an average of 96 per week.

Each incineration requires about 1¼ hours at a temperature of 920° to 1,100° C. Over a large number of cremations they have found that the average gas consumption per case is 2 therms, the highest being 3 therms and the lowest 1·2 therms.

In general, the design of cremation furnaces in Germany has been based upon the rather massive brick construction used for the solid fuel furnaces, but later designs are smaller and lighter although still more massive than the average English ones.

The coke-fired furnaces had an opening in the rear wall leading to the combustion space below, but when adapted for gas firing the back wall was bricked up and the burner fired through it (fig. 8). In both kinds of furnace the air for combustion is pre-heated in suitably arranged recuperators, and some manufacturers provide a burner consuming 1·8 therms per hour which is used to heat the flues and the muffle as a preliminary in order to produce from the main burner a flame which fills the whole muffle and reduces the heating-up time.

One of the latest furnaces by J. A. Topf und Sohne, of Erfurt, has a single burner firing through a back wall underneath the incinerator grate. This is designed to swing out before the introduction of the coffin the orifice being closed by a cast-iron door. This ensures that during the cremation no further gas is introduced. The heated air can be controlled during the cremation by means of dampers operated from a central position above the burner.

At Stuttgart Crematorium the coke-fired cremation furnace was replaced in 1931 with a new type of gas-heated furnace, which has given very satisfactory results. It differs from previous practice in that, in place of the grid, it has a completely closed muffle fitted as closely as possible to the shape of the coffin and, with the exception of a small air pre-heating system for the secondary incineration space, recuperation is not employed. There is, however, a patent air supply system to the muffle through two hot air jets and twenty cold air jets, the performance of which can be regulated as necessary during the incineration. The burners are fitted for pressure air and low-pressure gas, the necessary air blast being produced by a fan which serves both the hot and cold air jets. This furnace is unusual by reason of the secondary incineration space, which is completely shut off by a refractory slide from the muffle proper and is separately heated. As soon as the incineration has proceeded far enough the slide is opened and the remains enter the secondary incineration space. The slide is then closed and the muffle is ready for the introduction of the next case. It is stated that the mixing of remains is rendered absolutely impossible by this arrangement.

Dr. Ing. E. H. Thau, of Berlin, in an article on Gas-Heated Cremation Furnaces, states that the method of construction of cremation furnaces has undergone a number of changes recently. The present state of development is marked by the use of gas as a source of heat. It is now possible to build and operate gas furnaces for this purpose which are undoubtedly superior, from the point of view of running cost, to the old coke-fired incinerators. A description is given of

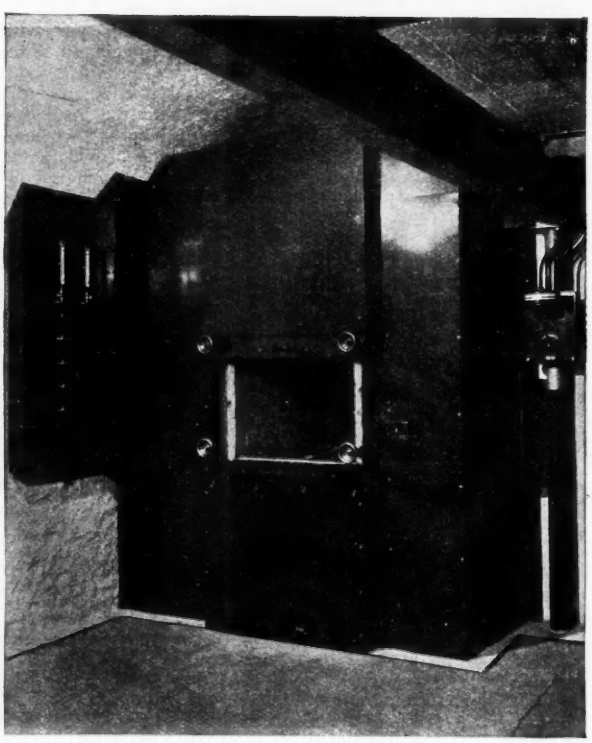


Fig. 6.

two new cremation furnaces by the Didier-Werke Company, of Berlin, of which one is intended for continuous operation and one for intermittent. In the case of the first, the incineration is begun on the grid which closes the muffle from beneath while secondary incineration is carried out by means

of hot air on the ashes hearth below. The ashes undergo a further combustion on a flat hearth and finally on a rocking grate shut off from the oven space above. Any particles of carbon which may have remained unoxidized are finally resolved without coming into contact with the flame from the second cremation which has in the meantime begun.

The intermittent furnace is of different construction, the height being much reduced, and gas burners are fitted in the

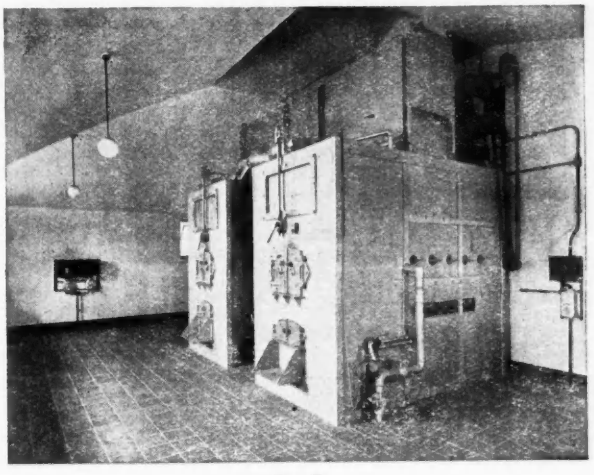


Fig. 7.

crown of the arch. Further, the floor of the incinerating chamber consists of fireclay tiles, of which the last third forms a grid through which the remains fall on to a sloping hearth. Such matter as is not fully oxidized is quickly reduced by the action of hot air which enters here, until pure white ash only is left.

A modern design of furnace by this firm is shown in fig. 9.

Another firm which has built a considerable number of cremation furnaces in Germany is Wilhelm Ruppmann, of Stuttgart.

Switzerland.

There are twenty Crematoria in Switzerland, that of Zurich being the largest. At this city the State Authorities installed two gas-fired cremation furnaces in 1932 in place of the existing coke-fired incinerators installed many years ago. The installation of the new furnaces was carried out by Messrs. Emch & Co., of Winterthur, and was governed by strict conditions for construction and operation laid down by the State Authorities as follows:

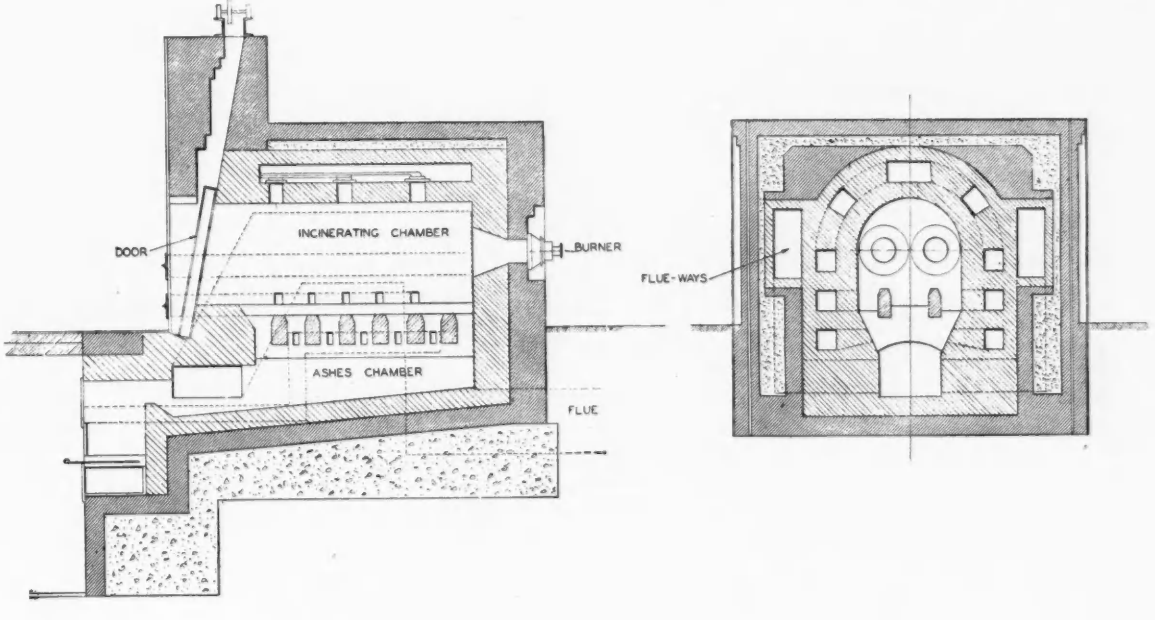
(1) Normal cremations should not take longer than the previous coke-fired ovens—*i.e.*, from 1-1½ hours.
(2) The process of cremation should be almost completed on the muffle grid, with simply a final incineration in the ash chamber. The cremation should be complete and the ashes cooled off before they are removed.
(3) The formation of smoke to be avoided at every stage of the cremation.

The following were advanced as the reasons which led to the choice of gas as a fuel:

(1) Ideal cleanliness of operation.
(2) The possibility of allowing the cremation to take place without smoke by turning off the fuel supply during the cremation.
(3) Economy of operation with gas heating.
(4) The unsurpassed controllability of gas firing, with the possibility of an instantaneous large supply of heat which could be increased or reduced as necessary.
(5) The avoidance of noisy hand operations.

The results have given entire satisfaction, and during 1937 2,050 cremations were carried out in the gas furnaces.

The equipment at Zurich consists of a muffle, ash chamber, and recuperator for pre-heating the air by means of waste gases. The most notable feature of this furnace is the provision of a mechanically operated brush for the extraction of the ash and, secondly, owing to the scanty dimensions of the chimney, induced draught fans have been fitted for the purpose of discharging the gaseous products of cremation. Suction fans of this type are well known in combustion engineering, but the Authors are not familiar with any Crematoria



GERMAN GAS HEATED CREMATORIUM FURNACE

Fig. 8.

countries, but it is particularly appropriate to do so at this Conference, for only last September at the International Congress held in London, there was formed an International Crematoria Federation.

The objects of the Federation are, of course, to study the Movement from an international point of view and, in this

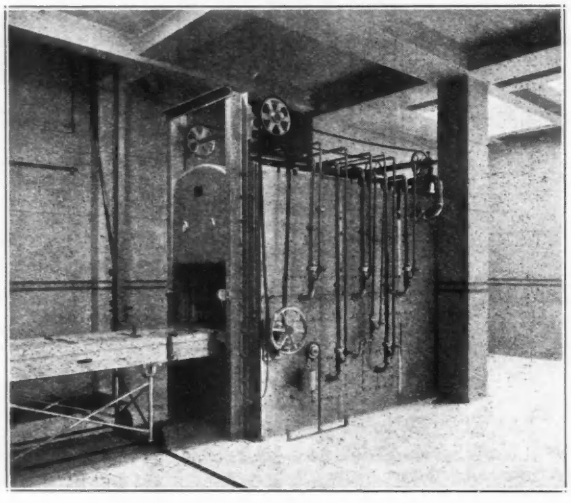


Fig. 5.

connexion, the Authors submit these notes, very far from exhaustive, on the trend of technical progress in Europe and America.

Europe.

Germany.

In the number of cremations carried out annually, Germany leads the world, for during the past five years the figures have crept up from 60,000 to 80,000 per annum. There are about 120 crematoria, in the great majority of which gas is used. There are two electrically heated furnaces at present, one at Erfurt and the other at Essen. As originally planned most of the German crematoria had coke-fired furnaces but these have gradually been converted or replaced by the gas heated ones. For instance at the Treptow Crematorium, Berlin, the obsolete coke-fired plant dating from 1913 was replaced in 1928 with two furnaces designed for gas and coke firing, but since then both furnaces have been converted to gas heating and a third since added has been equipped for gas heating only.

In Berlin alone in three Crematoria no fewer than 19,800 cremations took place in 1937, an average of 380 per week, while in London during the same year at six Crematoria, 5,000 cases were dealt with, an average of 96 per week.

Each incineration requires about 1¼ hours at a temperature of 920° to 1,100° C. Over a large number of cremations they have found that the average gas consumption per case is 2 therms, the highest being 3 therms and the lowest 1·2 therms.

In general, the design of cremation furnaces in Germany has been based upon the rather massive brick construction used for the solid fuel furnaces, but later designs are smaller and lighter although still more massive than the average English ones.

The coke-fired furnaces had an opening in the rear wall leading to the combustion space below, but when adapted for gas firing the back wall was bricked up and the burner fired through it (fig. 8). In both kinds of furnace the air for combustion is pre-heated in suitably arranged recuperators, and some manufacturers provide a burner consuming 1·8 therms per hour which is used to heat the flues and the muffle as a preliminary in order to produce from the main burner a flame which fills the whole muffle and reduces the heating-up time.

One of the latest furnaces by J. A. Topf und Sohne, of Erfurt, has a single burner firing through a back wall underneath the incinerator grate. This is designed to swing out before the introduction of the coffin the orifice being closed by a cast-iron door. This ensures that during the cremation no further gas is introduced. The heated air can be controlled during the cremation by means of dampers operated from a central position above the burner.

At Stuttgart Crematorium the coke-fired cremation furnace was replaced in 1931 with a new type of gas-heated furnace, which has given very satisfactory results. It differs from previous practice in that, in place of the grid, it has a completely closed muffle fitted as closely as possible to the shape of the coffin and, with the exception of a small air pre-heating system for the secondary incineration space, recuperation is not employed. There is, however, a patent air supply system to the muffle through two hot air jets and twenty cold air jets, the performance of which can be regulated as necessary during the incineration. The burners are fitted for pressure air and low-pressure gas, the necessary air blast being produced by a fan which serves both the hot and cold air jets. This furnace is unusual by reason of the secondary incineration space, which is completely shut off by a refractory slide from the muffle proper and is separately heated. As soon as the incineration has proceeded far enough the slide is opened and the remains enter the secondary incineration space. The slide is then closed and the muffle is ready for the introduction of the next case. It is stated that the mixing of remains is rendered absolutely impossible by this arrangement.

Dr. Ing. E. H. Thau, of Berlin, in an article on Gas-Heated Cremation Furnaces, states that the method of construction of cremation furnaces has undergone a number of changes recently. The present state of development is marked by the use of gas as a source of heat. It is now possible to build and operate gas furnaces for this purpose which are undoubtedly superior, from the point of view of running cost, to the old coke-fired incinerators. A description is given of

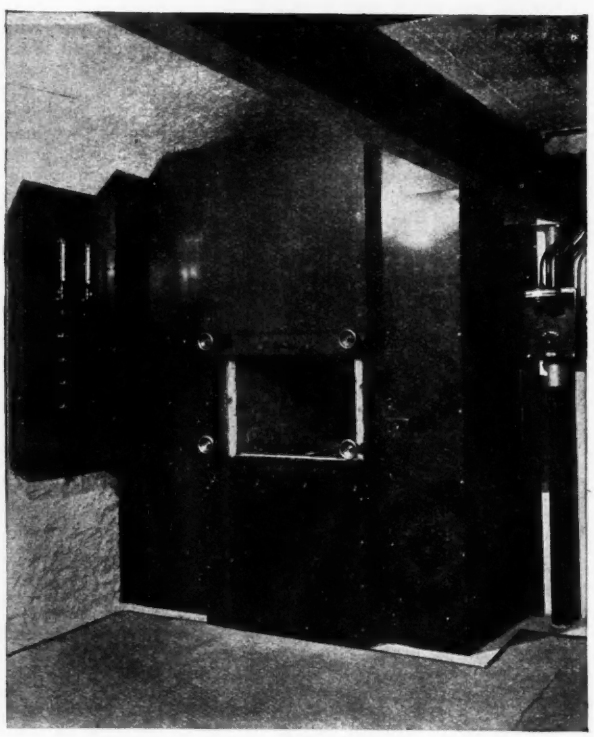


Fig. 6.

two new cremation furnaces by the Didier-Werke Company, of Berlin, of which one is intended for continuous operation and one for intermittent. In the case of the first, the incineration is begun on the grid which closes the muffle from beneath while secondary incineration is carried out by means

of hot air on the ashes hearth below. The ashes undergo a further combustion on a flat hearth and finally on a rocking grate shut off from the oven space above. Any particles of carbon which may have remained unoxidized are finally resolved without coming into contact with the flame from the second cremation which has in the meantime begun.

The intermittent furnace is of different construction, the height being much reduced, and gas burners are fitted in the

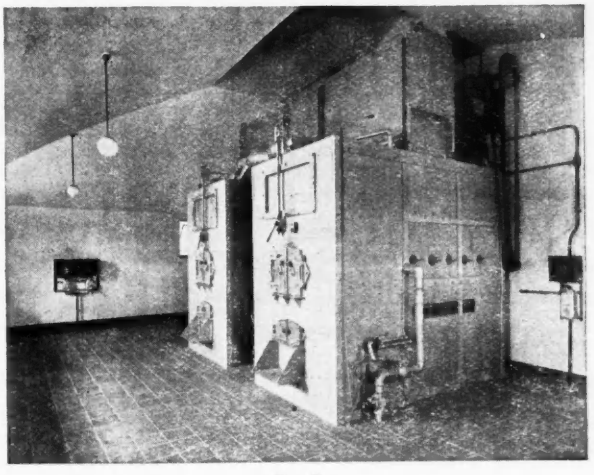


Fig. 7.

crown of the arch. Further, the floor of the incinerating chamber consists of fireclay tiles, of which the last third forms a grid through which the remains fall on to a sloping hearth. Such matter as is not fully oxidized is quickly reduced by the action of hot air which enters here, until pure white ash only is left.

A modern design of furnace by this firm is shown in fig. 9.

Another firm which has built a considerable number of cremation furnaces in Germany is Wilhelm Ruppmann, of Stuttgart.

Switzerland.

There are twenty Crematoria in Switzerland, that of Zurich being the largest. At this city the State Authorities installed two gas-fired cremation furnaces in 1932 in place of the existing coke-fired incinerators installed many years ago. The installation of the new furnaces was carried out by Messrs. Emch & Co., of Winterthur, and was governed by strict conditions for construction and operation laid down by the State Authorities as follows:

(1) Normal cremations should not take longer than the previous coke-fired ovens—*i.e.*, from 1-1½ hours.

(2) The process of cremation should be almost completed on the muffle grid, with simply a final incineration in the ash chamber. The cremation should be complete and the ashes cooled off before they are removed.

(3) The formation of smoke to be avoided at every stage of the cremation.

The following were advanced as the reasons which led to the choice of gas as a fuel:

(1) Ideal cleanliness of operation.

(2) The possibility of allowing the cremation to take place without smoke by turning off the fuel supply during the cremation.

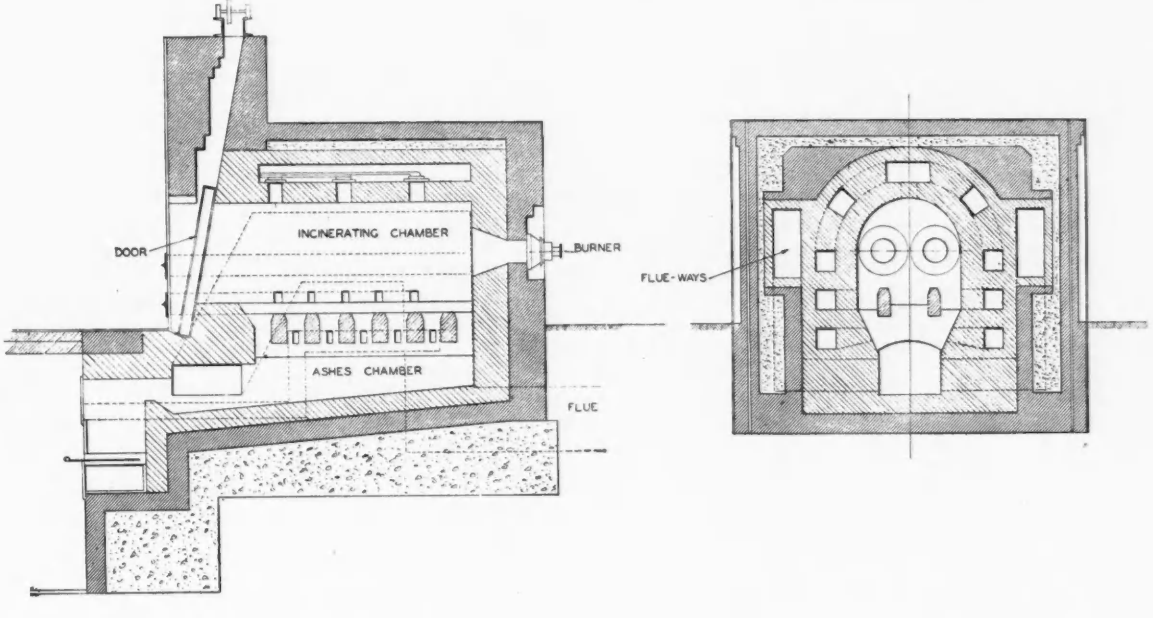
(3) Economy of operation with gas heating.

(4) The unsurpassed controllability of gas firing, with the possibility of an instantaneous large supply of heat which could be increased or reduced as necessary.

(5) The avoidance of noisy hand operations.

The results have given entire satisfaction, and during 1937 2,050 cremations were carried out in the gas furnaces.

The equipment at Zurich consists of a muffle, ash chamber, and recuperator for pre-heating the air by means of waste gases. The most notable feature of this furnace is the provision of a mechanically operated brush for the extraction of the ash and, secondly, owing to the scanty dimensions of the chimney, induced draught fans have been fitted for the purpose of discharging the gaseous products of cremation. Suction fans of this type are well known in combustion engineering, but the Authors are not familiar with any Crematoria



GERMAN GAS HEATED CREMATORIUM FURNACE

Fig. 8.

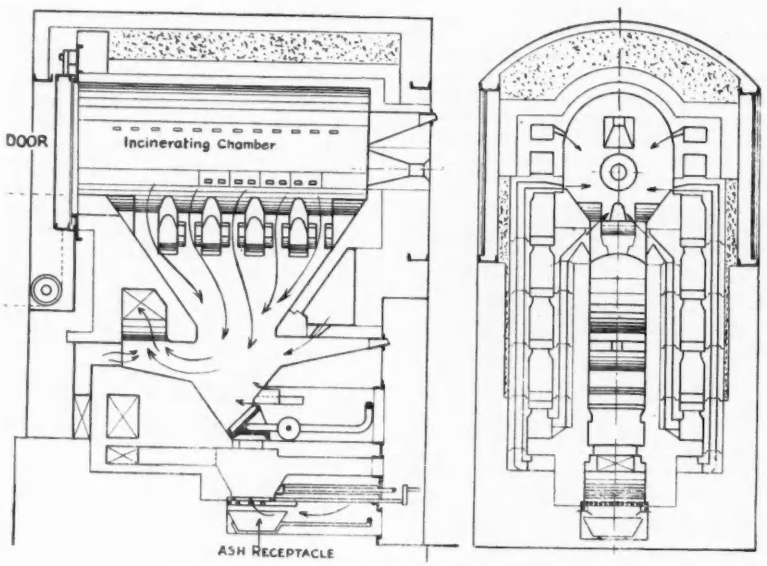


Fig. 9.

installations so fitted in this country. An illustration of this furnace is shown in fig. 10.

Czechoslovakia.

There are thirteen crematoria in this country, of which five are gas heated; one crematorium is equipped for oil, one electric heated, and the remainder are at present constructed for the use of solid fuel. The total number of cremations for 1937 was 6,369.

The gas-fired furnaces at Brno and Ollomonc are constructed on the surface combustion system with radiant heat, similar in principle to those installed at Putney Vale and elsewhere in this country. The remainder are of the more usual type and call for no special comment.

Sweden.

The number of cremations in Sweden in 1937 was 3,942, which was 16% greater than the number in 1936, and varied as between one district and another in the percentage of the total number of deaths from between 4% to 36%.

The Scandinavian countries do not enjoy the advantage of natural coal deposits and have to rely to a large extent on imported fuel, of which coke from the United Kingdom is popular.

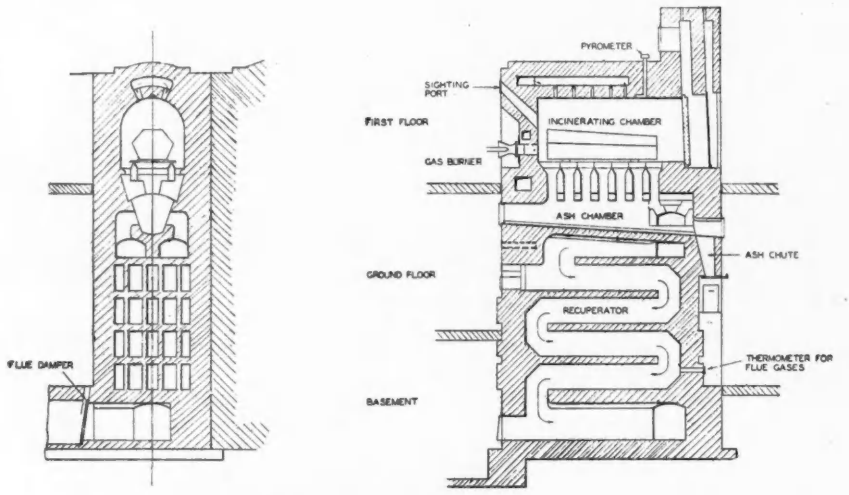
It is of interest, therefore, that out of twenty-seven crematoria nine are oil heated, eight gas, seven coke, and three electric, the energy for the latter being derived from water power.

Other European Countries.

Though crematoria are established in some Roman Catholic countries, the number of cremations carried out is comparatively small, for, as is well known, the practice of cremation is not approved by the Roman Catholic Church.

United States of America

In the United States of America, gas or oil is invariably used in the crematoria, and there is a large preponderance of gas incinerators. The absence of smoke and odour is regarded as of supreme importance, and it is largely for this reason that gas is so much favoured. In the light of the following observations, it is not surprising that American equip-



CREMATION FURNACE INSTALLED IN ZURICH.

Fig. 10.

ment should appear to differ from current British practice, for natural gas at a very low price is available over a widespread area.

The Authors received, from an authoritative source, considerable information, from which the following has been extracted:

There are a considerable number of cremation furnaces operated with gas in America, but there is no one type which can be referred to as outstanding. To understand the problem involved in America in the operation of cremation furnaces, one must appreciate the fact that there is more to be considered than merely a heating proposition, for it is considered necessary that the operation first of all should begin from a cold start, for the casket must be placed in the cremation chamber before the application of heat; secondly, that there be no smoke in evidence whatever during the operation, and thirdly, that it shall be quiet. Of these three requirements, the question of smoke presents the biggest problem, as the majority of American caskets have a considerable amount of cloth on the outside and, when burning first begins, emit large quantities of smoke. It has, therefore, been found necessary to find some means of passing the smoke thus formed through a heating chamber. If smoke can be satisfactorily disposed of, the remainder of the problem is relatively simple.

It has been found, in the ordinary way, that there is sufficient combustible material in the casket and its lining to provide enough heat for the complete cremation, which is supplemented by the addition of air blown in to aid the oxidation. Bodies, however, vary considerably, and in some cases it is necessary to supply heat practically throughout the cremation.

In general, equipment capable of supplying 10 therms per hour per furnace is provided, which is able to complete an average cremation in one hour ten minutes. Of course, with the very low rates prevailing for natural gas in America the use of 2,000 to 3,000 cu.ft. per cremation is not of material importance.

Difficulties are not altogether unknown in the United States, for sometimes morticians supply unsuitable linings to the caskets, consisting of patent fillings and excessive quantities of cotton wool; also there is a more general complaint of the use of metal caskets. There is another problem not hitherto met with in this country—namely, the impregnation of the wood of the coffin with sodium fluoride, a substance that acts more or less as a fire proofing compound and which may result in a coffin taking so long as four hours to burn down.

American engineers have given special attention to the refractory linings to their furnaces, and use a fireclay which is of suitable composition to resist the slightly acid reaction of the ash.

It is of interest to note that cremation furnaces are also supplied to medical schools, the University of Pennsylvania and Rochester being two of those thus provided. These furnaces are smaller than the standard unit and are designed for the purpose of disposing of the dissected remains used for instructional purposes.

APPENDIX.

Ancillary Services.

Heat is required for various purposes in the crematorium buildings, for example, in maintaining the Chapel and anterooms at a comfortable temperature and in the provision of hot water for cleaning and cloakroom purposes. This Paper would not, therefore, be complete without some reference to the service the Gas Industry is able to offer in this direction.

For space heating the systems available may be divided broadly into two groups:

(*a*) Those systems providing direct heating by convection and radiation.

(*b*) Indirect installations comprizing a central source of heat distributed by means of hot water, steam, or hot air conveyed in pipes.

(*a*) In the first group are included all those appliances in which gas is burned in the position where the heat is required, for example, gas fires, floor type flueless radiators, medium temperature radiant panels (Bratt Colbran, Ltd.) and high temperature radiant panels (Radiant Heating, Ltd.).

The choice depends upon their appearance in conjunction with the achitectural features and furnishing of the premises, and the facility with which they can be installed. Apparatus of this description also has the merit of providing comfortable conditions in a very short time after being brought to use, as well as high efficiency in operation and economy in running costs.

Gas fires are often fixed in ante-rooms and offices, and quickly give comfortable conditions with a cheerful radiant glow.

(*b*) Of the second group, hot water central heating is probably the most popular and is readily provided by specially designed gas boilers, thermostatically controlled and clock ignited. With automatic heating of this type it is not necessary for the attendant to visit the crematorium until a very short time before the ceremony, for the clock will have set the boiler into action at a pre-arranged time and the building will be warmed ready for use.

Included in this category also are the indirect air heaters for the circulation of warmed air automatically and a well-known example of this type can be seen at Golders Green, where the Grundy "Hestia" air heaters are gas fired and were mentioned in the previous Paper.

It is customary to provide hot water for cloakroom use and a number of appliances are available to meet this need.

Pensions for Employees

National Benzole Company's Scheme

A new pension and life assurance scheme has been introduced by the National Benzole Company. It provides for employees over twenty-one years of age in receipt of a minimum salary of £2 per week, who are not included under the Company's existing scheme. Every effort has been made by the Company to secure maximum benefits for all participating, and they have safeguarded the interests of older employees by providing additional pensions for past service.

This is another milestone in the history of an organization whose development may justifiably be called a romance of industry. As recently as 1919, when the Company was formed by the British benzole producers, benzole was scarcely known as a motor spirit. Now the Company has branches throughout the country, and National Benzole Mixture, the home-produced British benzole fuel, is a leading motor spirit, giving employment among others to people in the British mines, iron, steel, and gas works.

In these days, when closer co-operation between employers and their staff is so essential, it is pleasing to have this further example of a great British company promoting the welfare of those in its service.

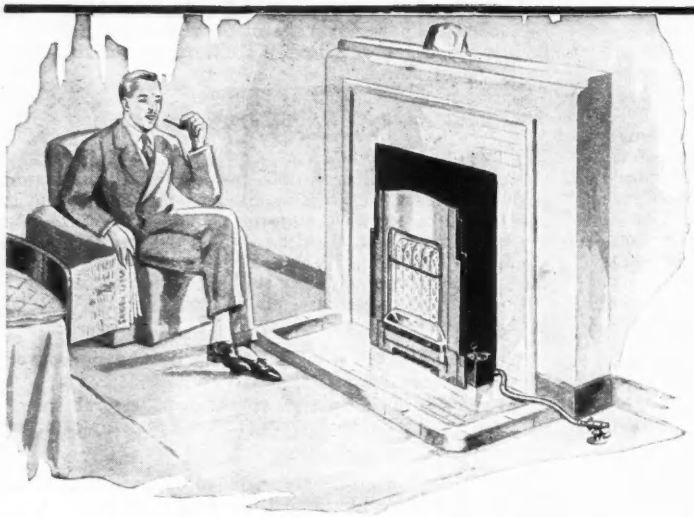
Progress at Worcester

Mr. G. P. Mitchell Elected to Board

As announced elsewhere in this issue, at the annual general meeting of the Worcester New Gas Light Company held on July 27, Mr. George P. Mitchell, M.Inst.C.E., M.I.Mech.E., Engineer and General Manager to the Company, was unanimously elected to the Board of Directors.

During the five years Mr. Mitchell has been with the Company new carbonizing and purifying plant has been installed to cope with an increase in consumption, which has risen from 387,852,000 cu.ft. to 561,339,000 cu.ft. To retain and increase the consumption *per capita* of domestic consumers was Mr. Mitchell's first and foremost objective, with the result that, although no additions have been made to the Company's area of supply, domestic consumption has increased. Realizing the important part gas was likely to play in industry, Mr. Mitchell did not hesitate to advocate its use among manufacturers, with the result that to-day most of the industrial enterprises in the City are using town gas for production purposes.

Not without significance is the fact that, during the past eighteen months, four members of Mr. Mitchell's staff have been promoted to responsible positions in the Industry.



EMPIRE EXHIBITION, GLASGOW
Stand 123/127, Palace of Engineering

Portable Prepayment Gas Heating for the Hotel Guest

☆

HERE IS THE NEATEST AND MOST COMPACT PORTABLE PREPAYMENT GAS-HEATING INSTALLATION YET DEVISED

☆

IT OPERATES BY MEANS OF ITS TIME-CLOCK AND A SIXPENNY-PIECE. The time set for the Sixpence can be varied between A QUARTER OF AN HOUR and FOUR HOURS, and any unused period may be CANCELLED.

☆

NOTE.—The TIME-CLOCK, which is British built and thoroughly reliable, can also be supplied as an independent unit, for use with "fixed" types of gas-fires, etc.

MAIN

Further particulars from

R. & A. MAIN LIMITED
LONDON and FALKIRK

AN ECONOMICAL INSTALLATION FOR HOTELS, BOARDING HOUSES, etc.

A few of these units will cover the heating requirements of many bedrooms. Easy to carry about—total weight, approximately 20 lbs.

GASCLOCK
PREPAYMENT *Gas-fire* INSTALLATION

Literature available for distribution and Showroom use.

Road Tar Properties

From a Paper at the International Road Tar Conference, Scheveningen, June 20

of Technical and Economic Importance

by

Professor Dr. H. MALLISON,
of Berlin

The fundamental object of tar road construction is to bind the stones together with tar and to obtain a resisting layer on the road surface. As many variations can now be made in the kind and size of stones used, the ratio of tar to stone, the thickness of the covering, the quality of the tar, and finally in the method of construction, the result is naturally that an extraordinary number of variations is possible in the final product. The art of the engineer also enters into the question and must continually strive to the utmost to develop only a few standard methods of construction which comply with the varying requirements imposed on the structure by the foundation and the traffic load. The following five methods of construction have crystallized out as the result of countless individual observations, successes, and failures. They are recognized as current practice by every expert: Surface tarring; tarmacadam (*a*) ordinary process, (*b*) semi-hot process, (*c*) hot process; tar grouting.

The choice of the proper quality of tar for the particular purpose in view is of the greatest importance. The following, which I advanced years ago, may serve as a fundamental rule: "The most viscous quality of tar should always be used which is applicable to the particular system of working and to the particular time of the year."

For grouted and tarmacadam surface coverings, including hot-process tarmacadam, this selection has to-day become quite a simple matter; tars are mostly selected with a viscosity of from about 40 seconds at 30° C. to soft pitch of a drip point of about 35° C., and the right qualities, depending on the time of the year, are known for each type of construction. The conditions controlling surface tarring are quite otherwise; this, though in itself the simplest in practice, is, however, theoretically quite the most difficult method of construction. Surface tarring is in my view a method of construction that really includes all the above-mentioned four methods of construction of the covering (grouted and mixed coverings), but with the difference that in the first place the thickness of the covering is exceptionally small, and in the second place the formation of the correct constant granulation and the final characteristic of the tar are only first fully developed on the road. If one follows this fruitful idea, one can say: A surface tarring—as with every method of constructing a road with tar—must be so carried out that under the influence of rolling, traffic, and the atmosphere a kind of hot-process tarmacadam is automatically formed on the road and that out of the two simple basic materials, tar and chippings. A surface tarring will therefore be all the more durable and exhibit all the more a tight and mosaic-like structure, the nearer this ideal is approached. From this explanation the next noteworthy pleasing fact should also be readily understood, that all tars of the various specifications can be used for surface tarring, from thin liquid road tar to soft pitch-like road tar and weather tar (Wetterteer). The art of the surface tarrer consists in selecting the correct quality for the occasion which, in combination with the right chippings, will best and most quickly ensure the result described—that is, to obtain finally a thin layer of hot-process tarmacadam. In my opinion the same applies as well to the thin so-called carpet layers which are becoming more and more popular at the present day.

Roughness of the Tar Roads.

Tar roads are rough by nature and therefore give a hold and grip to the motor vehicle wheels even in rainy weather. In order to prepare a road surface for traffic in that quality which is commonly called "rough," two essentially different methods can be used. The surface can either be made "coarse gripping" or "fine gripping," and I would like to recommend that these two new expressions should be adopted in current German use, and also in suitable translations in foreign languages. The expression "sandpaper-like" which has become general in England, in my opinion represents about the same as my expression "fine gripping."

"Rough" should be the main description for safe traffic surfaces. A surface will be described as "coarse gripping" in which the larger stone chippings are embedded in a layer of stone and tough high binding power tar in such a manner that the points of the stones project and—particularly on stiff slopes—hold the wheels firmly and offer a good grip. We know that Switzerland has brought this process to perfection in recent times. Such a finish of the upper surface is also characterized by the fact that the road not only is non-skidding, but presents a non-skidding appearance to the motor driver, and therefore gives him a feeling of safety when he approaches this surface. This psychological effect is, of course, to be taken into consideration. The other type of construction, which I will describe as "fine gripping" and which is of importance, particularly with tarmacadam and hot-process tarmacadam, of course reduces the more or less jagged top surface section; it forms in itself quite a level and even and apparently smooth surface, but makes full use of the well-known valuable property of tar to which I called attention some 10 years ago. Under the traffic, the external stone surfaces become free and in this way a durable mosaic is built up on the top of small stone surface, the cracks between which are filled up with a concrete-like mortar. The traffic then runs as it were on a stone surface, the roughness of which gives a grip to the rolling wheel even in wet weather. An intermediate form between these two extremes is presented by a surface in which the projecting stone splinters are small to medium size; such a surface can be described as "medium gripping."

Both methods of construction lead finally to road surfaces safe for traffic; it will depend on the kind of traffic and the incline of the road as to which process is to be preferred in individual cases. From the point of view of permanence and durability, it can be stated that a road surface will suffer all the less from displacement of stones and chippings, the less the stones project free and therefore the smaller the side tipping effects are. In conclusion of this section I must not fail to point out that the roughness of the tarred roads, even at the commencement of rain and with moisture caused by fog, remains unimpaired. This is obvious in the case of coarse gripping surfaces; it also applies, however, to the fine gripping apparently smooth coverings, and is without doubt a special advantage of road tar. A tar covering can be claimed to be safe for traffic in all circumstances.

Softness and Liveliness of Tar.

Road tar is a comparatively soft binding material and a whole series of advantages can be derived from this quality. A soft binding material can be comfortably despatched, stored, and drawn off, but, above all, it permits the stone to be easily and regularly surrounded. Even in cool weather the tar soaks deeply into the surfaces to be tarred and is therefore particularly suitable for first treatment and for the spraying of road metal on which medium-heavy or heavy surface coverings are to be placed. Flaking off or shrinking of the tar is excluded by proper selection of the viscosity. The softness of the tar binder also favours its application for the building on of heavy covering surfaces out of a framework of stable sized metal, the density of which is still further increased by the traffic pressure. Only with a soft binding material can true tarmacadam top coverings finally be made, with which, under the influence of the traffic, such a far-reaching compression and reduction of the size of the stone sets in that

GAS PURIFIERS

Our illustration shows the purifier installation at the new Wincobank Works of the Sheffield Gas Company. It is designed to deal with 12,000,000 cubic feet per day and comprises 12 purifiers measuring 40′ square by 6′ 6″ deep.

Our long experience and the high standard of our work has earned for us the leading place amongst manufacturers of Gas Works Plant. Our Technical Staff is at your disposal for the preparation of schemes and tenders to meet your special requirements.

Other specialities are Gas Cleaning and Washing, Benzole Recovery, Ammonia Products, Gasholders, Tanks and General Iron and Steel Work.

NC.

NEWTON CHAMBERS & CO., LIMITED

THORNCLIFFE IRONWORKS • NR. SHEFFIELD

such coverings after lying for years are practically tight and free from hollows.

A further special property of great technical importance is its behaviour under change of temperature. As with all plastic materials, the tenacity of tar falls off with rising temperature and in fact in accordance with the well-known exponential law. Now, the comparatively steep course of the viscosity curve is characteristic for tar or, expressed in another way, the angle of inclination of the viscosity straight lines represented logarithmically is comparatively great. Consequently, the range between the setting points and the dripping points is not a very great one. Too great a value was, however, in my opinion formerly attributed to the magnitude of this difference. The matter was considered as simple. In winter, temperatures were met with in the top covering down to—30° C. and in summer up to 50° C.; therefore a difference of at least 80° C. must be demanded, otherwise cracks in the tar covering in winter and softening in summer would have to be feared. The inexactitude of such a primitive conception has long been established by practical experience and observation. The tar is not active in the fine form in the top covering and as such does not serve as bearing material. The covering consists much more of a purposely designed system of tar and stone, and the size of stones varies from ballast and splinters down to the finest stone dust. This stone dust now forms a mortar with the tar, a so-called filled tar, and with such a filled bituminous binding material the degree of plasticity represented by the temperature difference between the setting and dripping points is considerably increased. I would like to remind you here of the opinions expressed on this subject by Pfeiffer, Saal, Evans, and Pickard, as well as Sabrou and Renaudie. The presence of a decided structure contributes to the essential plasticity and such a structure is always present in a well-built tar covering; the structure is either produced according to plan or is formed automatically under the influence of the traffic—as, for example, with tarmacadam or surface tarring. I measured a temperature of—25° C. in a German hot-process tarmacadam covering in the Siberian winter of 1928-29 and 52° C. in the summer; the covering was neither split in winter nor was it washed away in summer.

The rather steep viscosity curve indicates a still further advantage for the tar in so far as the fluctuating day and seasonal temperature lends a certain liveliness to it in the covering framework. Tar surfaces grow together and become more dense under traffic; the tar percolates into all joints, moistens them, and seals them. Also its highly characterized capillary attraction, which is closely related to its high surface tension of about 40 dynes, causes it to penetrate into all joints and hollow cavities. A condition for the development of these good qualities is, however, naturally a constant correct measurement of the quantity of tar per sq.m. of surface or per cub.m. of stone. If the quantity of tar is too great, then the troublesome appearance of sweating arises. Many years' experience has proved, however, that properly constructed tar roads do not sweat.

After-Thickening of the Tar.

The usual distillation analysis separates road tar into four fractions: Middle oil, heavy oil, anthracene oil, and pitch. For practical road construction it can now be appreciated that the true binding material, the main object of which is to fasten the stones together, is a mixture of pitch and high boiling tar oils. The relatively low boiling oil fractions, on the other hand, vaporize in the course of time, after they have fulfilled the most important duty of rendering the tar fluid and workable, and to enable it to distribute itself throughout the stone bed. Tar which, under the influence of its content in middle oil, is comparatively easily fluid when warm percolates into all cracks and cavities and then thickens there and develops its binding power, above all through volatilization.

The following guiding rule appears to me personally correct: "Every kind of road tar in and on the road tends in the course of time to be transformed into a tenacious pitch-like binding material with a drip point of about 30°; the road construction is only successful and durable if this transformation takes place at the right time and the favourable quality of the road tar attained in this manner remains in the dense covering or layer."

This transformation should not, however, in any way proceed to pitch formation and brittleness; the coincidence of the attainment of high tenacity of the tar with full density of the road covering at the right time is in my opinion much more the whole secret of the art of tar road construction. If the covering is sealed on top, the tar in the layer below remains too fluid and stability is then insufficiently assured by a stable stone basis in combination with the right proportion of tar, and so the coverings continue to move and form waves. A surface tarring also will not hold on the covering. If, on the other hand, owing to faulty sealing, constructional errors, or too little compression from the traffic, the covering remains open and permits the accession of air, water, and dirt, then the tar will become harder and harder and the covering will finally, under the influence of the traffic shocks, crumble and disintegrate. I can see a confirmation of this point of view among others in the fact that for the construction of hot-process tarmacadam free from cavities, tar is usually taken which has the correct final tenacity at once, and that when extracting old well-preserved tarmacadam coverings a tar extract is always obtained which exhibits the high viscosity previously described.

For testing the degree of impermeability of bituminous coverings, moreover, I recently indicated a practicable method which consists in fixing pipes filled with water on the road. I was able to show that in a special case a hot-process tarmacadam covering newly constructed but purposely left partly untarred was not at all tight in spite of six months' summer motor traffic. On the tarred surfaces, on the other hand, the covering allowed no water to penetrate right from the commencement and it had therefore time to tighten up under the effect of the traffic without the tar being subjected to the injurious effects of the atmosphere.

Filler Tars.

Road tars filled with pulverized materials such as coal, limestone, and burned slate are manufactured and used to a large extent, especially in France. These filled tars have a higher viscosity than the normal road tars from which they are derived. Other methods are known for obtaining an increase in viscosity, and experience must show which way will prove best to serve the purpose in view.

There is still the tar bitumen mixture to be considered or the field where the tar and the bitumen industries work together. In the course of time it has been learned how these two chemically and physically different binding materials behave to each other, in what mixture ratios they harmonize and permit their good properties to combine with each other. In order to avoid an infinite number of theoretically possible mixtures it has been generally agreed in Germany to limit the manufacture to two mixture ratios—*i.e.*, 85% tar, 15% bitumen, and 70% bitumen to 30% tar. Distinctions are also made between asphalt, tar concrete, and tar-asphalt concrete, whereby in the first case the tar and in the second case the bitumen is in excess in the mixture of binding agents.

Discussion.

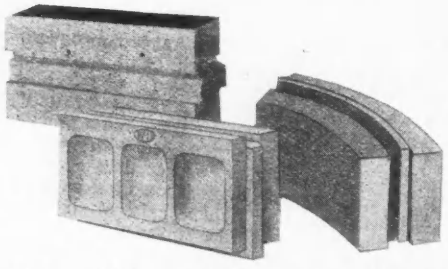
Dr. W. H. GLANVILLE (Assistant Director of Road Research, Department of Scientific and Industrial Research) said that the use of soft pitch as a road binder appeared to have met with considerable success in Germany. One might therefore ask the question why did they not find it in more common use in other countries where in some cases the degree of variation of atmospheric temperatures might be considerably less than was found in Germany. This would seem to be one direction for new development which should meet with success. In this connexion they had a specification for hot process tarmacadam in Great Britain and this had developed to this point largely as the result of the efforts of Mr. Cone. Its use had, however, not been very extensive to date.

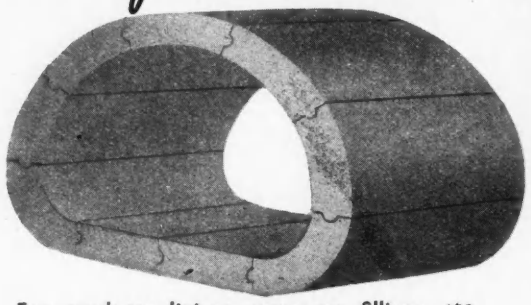
Mr. H. W. JAMES (Manager, South Metropolitan Gas Company's Tar Works) remarked that in order to clarify the confusion into which viscosity figures had been thrown by the adoption of a viscometer having such a narrow range of utility at any one temperature, G. H. Fuidge, of the South Metropolitan Gas Company, and his colleagues had developed an equiviscous scale to which, by ascertaining the temperatures at which they had the viscosity 50 sec., tars and pitches of all grades might be referred for comparison. This scheme possessed the advantage that the equiviscous temperature (E.V.T.) of a mixture of tars was the

REFRACTORIES

For the Gas Industry

Retort sections and special shapes for horizontal and vertical installations can be relied upon to give trouble-free and economic service when made in "BLUEBELL" 95% Silica material.





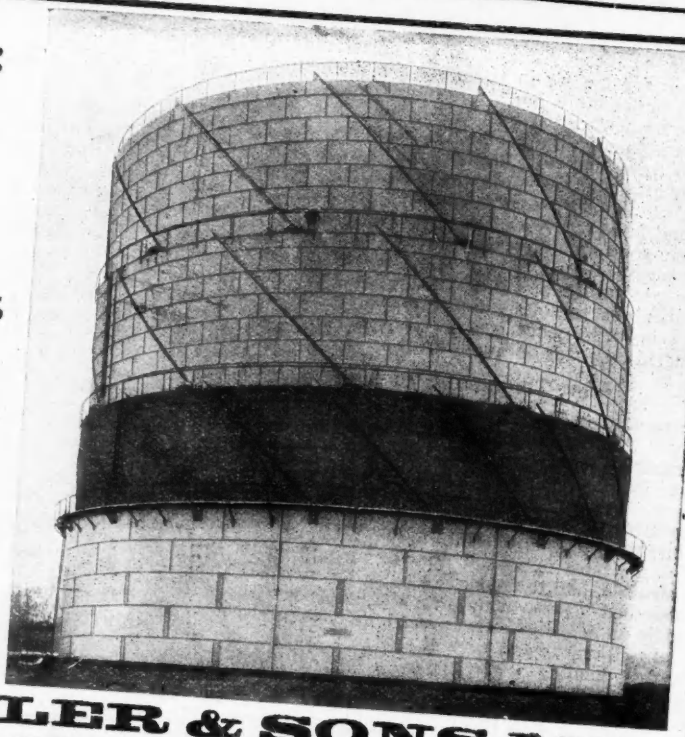
For producer linings, water-gas fillings, etc., "THISTLE" (35/37% alumina) and "STEIN" (30/32% alumina) firebricks are admirably suited by reason of their excellent high temperature properties.

We are exhibiting at the Empire Exhibition, Glasgow, May—Oct., 1938, STAND No. 55, Palace of Engineering.

JOHN G. STEIN & Co LTD BONNYBRIDGE SCOTLAND

GASHOLDERS:
GUIDE FRAMED
SPIRAL
WATERLESS
INSPECTION & REPAIRS

GASWORKS PLANT
AND
STRUCTURAL STEEL WORK



SAML. CUTLER & SONS LTD.

39, Victoria Street, WESTMINSTER
ABBEY, 3121
RETORTUS, SOWEST, LONDON

LONDON

TELEPHONES:
TELEGRAMS:

Providence Iron Works, MILLWALL
EAST, 5231
CUTLER, MILLWALL, LONDON

458

arithmetical average of the E.V.T. of its constituents. The scheme was submitted to the Standardization of Tar Products Tests Committee, the members of which made valuable suggestions, and it had now been published by the Committee. T. H. Blakeley, of the South Yorkshire Chemical Company, had published an interesting and suggestive Paper indicating a method whereby, using the properties of specific gravity and viscosity, it was possible to effect a classification of tars and tar oils resulting from various systems of coal carbonization. The Industry was looking forward with interest to the publication of further work by this Author, particularly dealing with the correlation of other properties. G. H. Fuidge and his associates had spent several years of laboratory work in designing what Dr. Mallison defined as "thin carpet layers." By the courtesy of highway engineers, parallel experiments had been carried out on the roads. As the result of painstaking quantitative work, many scores of miles of these carpet layers, some of them constructed with difficult aggregates, were giving good service in Great Britain, and had preserved their non-skid characteristics for several years. This was an excellent example of collaboration between fundamental laboratory work and practical application.

Mr. W. G. ADAM (Superintendent, Products Works, Gas Light and Coke Company) observed that Professor Mallison had referred to the gradual increase in the viscosity of a road tar exposed to the atmosphere, due to the evaporation of tar oils. They generally referred to this as the setting of tar, and their work had shown that high and low aromatic road tars exhibit marked differences in this respect. At ordinary temperatures—*e.g.*, 12°-20° C.—high aromatic tars lost weight and increased in viscosity at a faster rate than did low aromatic tars. At temperatures around 40° there was little to choose between the tars in either respect. They found, moreover, that the setting properties, at ordinary temperatures, of road tars prepared by fluxing soft pitch, were controlled mainly by the soft pitch and that the character of the fluxing oil was of secondary importance. For this reason they applied a scheme of solvent analysis to both high and low aromatic soft pitches. They were able, by this means, to prove conclusively that the differences in setting between high and low aromatic tars were due to differences in the character of the light petroleum soluble fractions of the corresponding soft pitches. These differences were found to be due to the presence, in the fraction from low aromatic soft pitch, of waxy unsulphonatable material which could be isolated, and the addition of which to high aromatic tar conferred slow setting properties at ordinary temperatures.

The presence of this constituent was shown to account also for certain physical phenomena they found associated with low aromatic tars. On spinning tar films at speeds between 500 and 1,800 r.p.m., those prepared with low aromatic tars showed striking irregularities which changed from transverse striations to longitudinal breaks as the temperature of spinning was raised, finally disappearing at the transition temperature of about 32° C. High aromatic tars gave smooth unbroken films. Another effect peculiar to low aromatic tar was the formation of a mist when the surface of the tar was compressed at temperatures below the transition point. Both these phenomena could be "induced" in high aromatic tars by the incorporation of a small quantity of the waxy material he had previously mentioned. The transition temperature of approximately 32° C. represented the temperature above which the setting of low aromatic tar was no longer retarded by the presence of this material. The transition point of low aromatic tar could be readily lowered by blending with high aromatic tar. Professor Mallison had referred to tar-bitumen mixtures, and it was interesting to note that the addition of 10% of asphaltic bitumen was sufficient to lower the transition point of low aromatic tar from 32° to below 25° C.

Gas Undertakings' Results

Boness.

At the annual meeting of Boness Gaslight Company, Ltd., a gratifying report was submitted. It was stated the sale of gas had continued to increase; the income for the year amounted to £11,000, and the expenditure to about £10,000. From a total sum of £2,364, it was decided to pay a dividend of 8%, free of tax.

Colne.

Mr. A. H. Nicholson, Engineer and Manager of the Colne Gas Department, in his annual report, states that the total amount of gas made during the year was 229,283,000 cu.ft., and the amount sent out 229,367,000 cu.ft. Consumption was: Ordinary consumers, 65,344,800 cu.ft.; prepayment, 99,681,400 cu.ft.; industrial, 19,740,000 cu.ft.; public lamps, 27,956,300 cu.ft.; and works, 4,237,800 cu.ft. The gas made per ton of coal was 21,989 cu.ft., as compared with 21,085 cu.ft. the previous year, and the gas sold per ton was 20,809 cu.ft., as compared with 20,208 cu.ft.

Falkirk.

The Falkirk Corporation Gas Department reports an income of £73,475 and working expenditure of £56,816. Actual surplus was £16,659, but interest, sinking fund, and other charges absorbed £16,535, which, with debit balance from previous year, produced a deficiency at end of financial year of £1,866. A credit balance of £895 is budgeted for during the current year. In the estimates provision is made for £560 for a new station meter, £600 for a new governor, and £700 for retorts renewals, *plus* an increased charge of £733 for sinking fund. The present charges are to be retained—viz., 2s. 10d. per 1,000 cu.ft. for pre-payment meter users, 2s. 8d. for ordinary users, less discount of 6d. and 4d. respectively for users of 22,500 cu.ft. per annum. The industrial rate is 2s. 3d. per 1,000 cu.ft., less discounts ranging from 5 to 45%.

Lancaster.

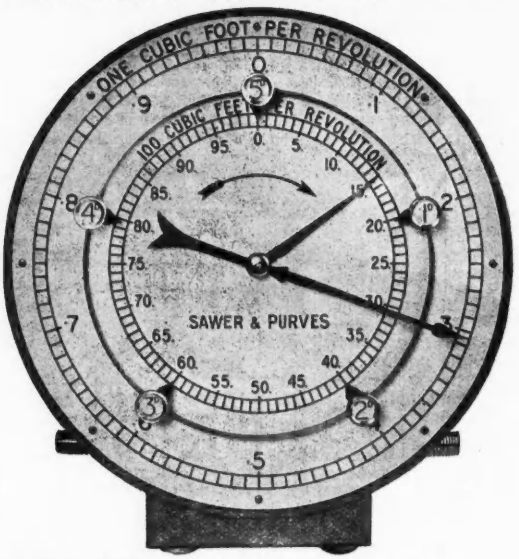
The working for the twelve months ended March 31 of the City of Lancaster Gas Department has resulted in a credit balance of £6,727 being carried to the Net Revenue Appropriation Account. Of this sum, about £4,000 has been applied to capital expenditure on new mains and meters, while £1,000 has gone to the General Rate Fund. The gas sold, including public lamps, amounted to 450,714,000 cu.ft., and the total accounted for to 459,839,000 cu.ft.—an increase over the previous year of 14,527,000 cu.ft., or 3¼%. Up to the end of the financial period the money borrowed amounted to £217,380. The outstanding loan debt, on the other hand, stood at the net figure of £21,603. Of 12,591 consumers, 7,089 take their supplies through prepayment meters. Though repairs to the two installations of chamber ovens have been undertaken, it is pointed out that the time is not far distant when the question of completely re-setting these inclined chamber ovens or of providing a new carbonizing plant of a different type will require to be considered. To comply with the requirements of the Factories Act, 1937, a contract has been made with the British Engine Boiler and Electrical Insurance Company to carry out the inspection of the gasholders.

Stoke-on-Trent.

The industrial side of the business of the City of Stoke-on-Trent Gas Department is increasing rapidly, consequent upon the great and sustained efforts which have been made so successfully to popularize the use of gas for ceramic firing. Details of the quantities of gas used in the firing of ceramic goods for each of the different sections of the trade (extracted from the report of the Department's Chief Engineer and General Manager, Mr. A. Mackay), which were reproduced on p. 235 of last week's issue of the "JOURNAL," show clearly the excellence of the results attained. The actual quantity of gas sold for industrial purposes (which includes pottery firing) five years ago was just over 224 million cu.ft., while now it has reached approximately 1,171¾ millions—an increase in this short period of more than 947½ million cu.ft., or 442%. Altogether the year ended March 31 last established a remarkable record in output and sales of gas; the increase in sales, as compared with the previous year, having been 483,766,300 cu.ft., or 21·86%, while the total amount of gas delivered was 2,886,745 000 cu.ft. The increased consumption during the past two years has been greater, as a matter of fact, than the total producing capacity of the Burslem, Longton, Stoke, and Fenton Works prior to the centralization of production at Etruria in 1923. The figures show that, while the gas sales in the past year were, as already mentioned, 21·86% greater than those of the previous year, the output was only 17·4% higher. Very nearly one-half of the gas sent out was coke-oven gas. The total number of consumers in the supply area at the end of March was 69,164—an increase on the year of 153. The average consumption per consumer has risen from 24,400 cu.ft. in 1934 to 37,400 cu.ft. in 1938—due entirely to the expanding consumption of existing industrial consumers and the increase in the number of new consumers for manufacturing purposes. The number of public lamps in the district continues to increase; the total of 6,051 showing a net increase of 171 on the year. Of the net profit for the year, £10,000 is transferred to Working Capital Account and £20,908 to Reserve Account.

OF SPECIAL INTEREST TO YOU!

DEMONSTRATION METER



IDEAL FOR COOKERY LECTURES, ETC.
A VALUABLE ADDITION TO THE MODERN GAS SHOWROOM.

MAY WE SEND YOU DETAILS?

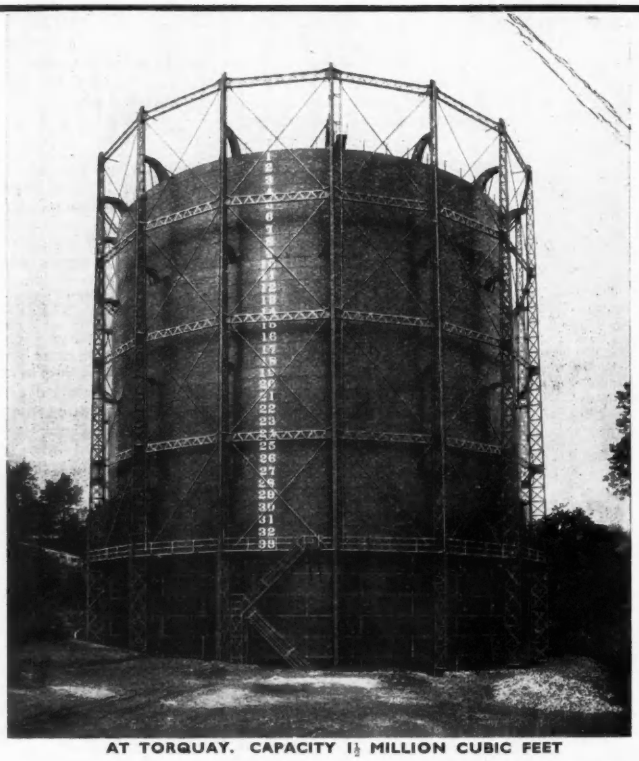
100 CU. FT. SMALL HIGH CAPACITY SIZE

SAWER & PURVES
Branch of Meters Ltd.

RADFORD METER WORKS
NOTTINGHAM
PHONES 75202.

NELSON METER WORKS
MANCHESTER 10
COLLYHURST 2289

DERBY ROAD
WATFORD
2645.



AT TORQUAY. CAPACITY 1½ MILLION CUBIC FEET

C. & W. WALKER
LIMITED
DONNINGTON, Nr. WELLINGTON—SHROPSHIRE
'Phone: Lilleshall-Shropshire Nos. 34 & 35 (2 lines)
'Grams: "Fortress," Donnington, Shropshire

GASHOLDERS

GUIDE FRAMED
AND
SPIRAL GUIDED
WITH OR WITHOUT
STEEL TANKS

WATERLESS
AND
HIGH PRESSURE
HOLDERS

MATERIALS—BRITISH.
CONSTRUCTION—IN OUR OWN WORKSHOPS.
ERECTION—BY SPECIALISTS.
RIVETED OR ELECTRICALLY WELDED.

LONDON OFFICE - 70, VICTORIA STREET, WESTMINSTER, S.W. 1.
'Phone: Victoria No. 1931
Grams: "Fortress," Soweat, London

Markets and Manufactures

Current Sales of Gas Products

The London Market

Aug. 2.

There is no variation to be recorded in the values of Tar Products in the London market, prices being as follows:

Pitch, nominal at about 33s. per ton f.o.b.
Creosote, about 4¼d.
Refined tar, 3¾d.
Pure toluole, 2s. 1d. to 2s. 2d.
Pure benzole, about 1s. 9d.
95/160 solvent naphtha, 1s. 7d.
90/160 pyridine, about 10s.
All per gallon naked at makers' works.

The Provinces

Aug. 2.

Crude Gas-Works Tar, 15s. to 20s.

To avoid misunderstanding, it is necessary to state that the above price is not claimed to represent a market value. It is a price worked out from week to week upon a system which has been used for many years as a basis for the fixing of certain contracts for crude tar of varying qualities in different areas.

The average prices of gas-works products during the week were: Pitch—East Coast, 31s. to 32s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 31s. to 32s.* Toluole, naked, North, 1s. 7½d. to 1s. 9d. Coal tar, crude naphtha, in bulk, North, 7¾d. to 8¼d. Solvent naphtha, naked, North, 1s. 4½d. to 1s. 5d. Heavy naphtha, North, 1s. 3d. to 1s. 3½d. Creosote, *ex* works, in bulk, North, liquid and salty, 4⅛d. to 4⅜d.; low gravity, 4¼d. to 4¾d. Carbolic acid, 60's, 1s. 9d. to 2s. Naphthalene, £13 10s. to £16. Salts, 80s. to 85s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal; "B" quality unsalable. Heavy oil: Unfiltered heavy tar oil, min. gr. 1,080, 4¾d. to 4⅞d.; filtered heavy tar oil, min. gr. 1,080, 5¼d. to 5⅜d.; heavy tar oil, gr. less than 1 080, 4½d. to 4¾d.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Scotland

GLASGOW, *July* 30.

Orders are very scarce, but quotations show little or no alteration during the week.

Crude Gas Works Tar.—Actual value is about 37s. to 38s. per ton *ex* works in bulk.

Pitch.—Supplies are available in substantial quantities at round 25s. per ton f.o.b. for export and 23s. per ton *ex* works in bulk for home trade.

Refined Tar.—Throughput is about normal in the home market at 3¾d. to 4d. per gallon, f.o.r. naked. Export business is quiet, with quotations at 3d. to 3¼d. per gallon in buyers' packages at makers' works.

Creosote Oil.—Demand is still slow, and the following prices can be taken as average: Specification oil, 4¾d. to 5d. per gallon; low gravity, 5¾d. to 6d. per gallon; neutral oil, 5d. to 5¼d. per gallon; all *ex* works in bulk.

Cresylic Acid.—Demand is infinitesimal and values are easy as under: Pale, 97/99%, 1s. 6d. to 1s. 8d. per gallon; Dark, 97/99%, 1s. 4d. to 1s. 6d. per gallon; and Pale, 99/100%, 1s. 9d. to 2s. per gallon; all according to quality *ex* works in buyers' packages.

Crude Naphtha continues to be valued at 5¼d. to 6d. per gallon *ex* works in bulk, according to quality.

Solvent Naphtha.—90/160 grade is 1s. 4d. to 1s. 4½d. per gallon, and 90/100 Heavy Naphtha is 1s. 1d. to 1s. 1½d. per gallon.

Motor Benzole is called 1s. 4d. to 1s. 4½d. per gallon.

Pyridine.—90/160 grade is 10s. 6d. to 11s. per gallon, and 90/140 grade is 11s. to 12s. per gallon.

Benzole Prices

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole..	0	9½	to	0	10	per gall. at works
Motor „ ..	1	3	„	1	3½	„ „ „
90% „ ..	1	4	„	1	4½	„ „ „
Pure ..	1	8	„	1	8½	„ „

Contracts Advertised To-Day

Coal.

Belfast Gas Department. [p. 318.]
Wallasey Gas Department. [p. 318.]

Re-sheeting Gasholder.

Tredegar Gas Department. [p. 318.]

Dividend Announcements

Croydon.—Interim for the half-year ended June 30, 1938, at the following rates per cent. per annum: Preference stock, 4; sliding scale stock, 7; and maximum dividend stock, 5.

East Surrey.—For the half-year ended June 30, 1938, at the following rates per annum: 6% on the cumulative preference stock, 4½% on the redeemable preference stock, 5½% on the preference "A" stock, and 6% on the ordinary "B" stock (as before), all less income-tax.

Trade Note

Welding and Allied Sciences.

"Sif-Tips," a quarterly magazine devoted to welding and allied sciences, is now in its seventh year of publication and has been entirely remodelled, offering a greater degree of interest to many thousands of welders at home and overseas. The publishers are Messrs. Willsmore & Tibbenham, Burlington Buildings, Norwich.

COMPANY NOTICES

HORNSEY GAS COMPANY.

NOTICE is Hereby Given that the TRANSFER BOOKS relating to the ORDINARY STOCK of this Company WILL BE CLOSED on the 10th August, 1938, and RE-OPENED on the 24th August, 1938.

By order of the Board,
K. LESLIE MORTIMORE,
General Manager and Secretary.

Gas-Works,
Hornsey, N. 8,
July 29, 1938.

THE BARNET DISTRICT GAS AND WATER COMPANY.

NOTICE is Hereby Given that the TRANSFER BOOKS of this Company relating to ORDINARY STOCK and PREFERENCE STOCK WILL BE CLOSED on the 17th August, 1938, and RE-OPENED on the 1st September, 1938.

By order of the Board,
E. D. DAVEY,
Secretary.

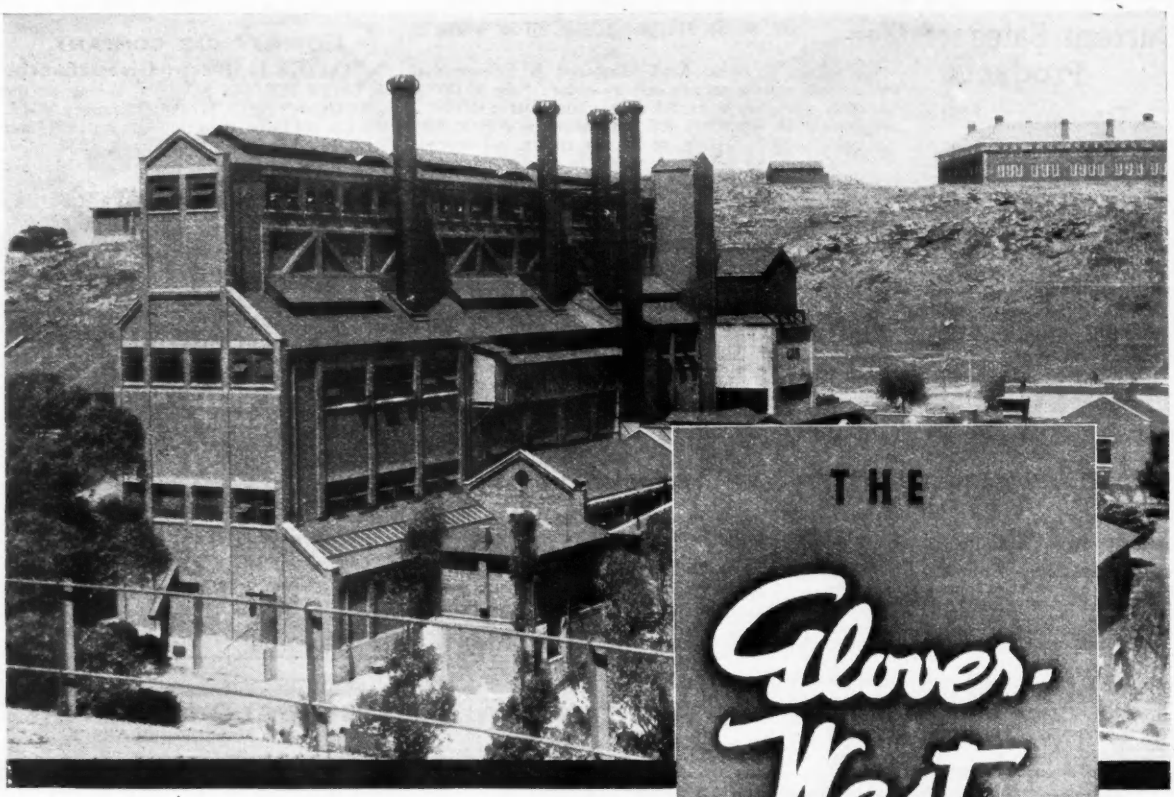
Offices:
139, Cannon Street,
London, E.C. 4,
July 30, 1938.

BUFFALO INJECTOR
(British Made) CLASS A
— FOR —
Hot or Cold Water and long lifts.

SEND FOR LIST.
GREEN & BOULDING, LTD.
162a, Dalston Lane,
LONDON, E.8.

CAST IRON PIPES
FOR
GAS, WATER, & STEAM
1½in. to 12in. BORE.
THOS. ALLAN & SONS LTD.,
Bonlea Foundry,
THORNABY-ON-TEES.
Telegrams: "BONLEA, THORNABY-ON-TEES."
Telephone No.: STOCKTON 66121 (Two Lines).

● CARBONIZATION IN VERTICAL RETORTS



The modern Glover-West vertical retort plant has behind it the accumulated experience of 64 years constant research and development for the advancement of gas production methods the world over.

● *423 plants have been built or are on order for 223 Gas Undertakings in 24 countries.*

The picture shows the three installations of Glover-West vertical retorts at Johannesburg City Council's Cottesloe gas works. The carbonising unit of the complete modern gasworks ordered for Johannesburg from this company in 1926 has been trebled to meet the rapid growth of demand. The latest extension put to work in 1937 is nearest the camera.

●

WEST'S GAS IMPROVEMENT CO. LTD.,

MANCHESTER: Albion Ironworks, Miles Platting ■ LONDON: Columbia House, Aldwych, W.C.2

GAS STOCKS AND SHARES

The Stock Exchange is quite inured to shocks nowadays, so that the disappointing results of the Great Western and L.M.S. Railways confined reactions almost to the home rail market. Elsewhere the tone was calm, and although holiday influences affected the volume of business, a nice steady investment buying movement has been going on. Gilt-edged stocks were strong at the close, the National Defence 3% loan reaching par. The industrial section produced a few good features, especially among iron, steel, aircraft, and motor shares, and a moderate amount of business was reported. Oils had a good week throughout, while gold shares were steady at the finish. The atmosphere at the present time is one of quiet confidence in the future as a result mainly of the reduced tension in European political affairs, and if this continues markets are looking forward to a considerable expansion in business after the summer holidays.

The Gas market was quiet and featureless. Prices, however, were held, and the few changes were mostly on the upgrade. In the Official List several more fixed-interest stocks rose a point or two, and the only drop was in Associated Gas and Water 4% preference by 1s. to 17s. At the Provincial Exchanges, Newcastle units recorded another gain of 3d. to 23s. 6d. and Weston-super-Mare 4% debenture was brought more into line with an increase of 3½ points to 97½. In the Supplementary List Hampton Court consolidated closed 4½ points lower at 140½.

There is not a wide choice of ordinary stocks available at the present time, but two parcels appear in the list which are attractive, viz., £1,000 Commercial at 85 yielding £5 17s. 6d.%, and £1,000 Imperial Continental at 126 giving a return of £7 17s. 9d.%. The debenture list is also very small, though a parcel of £1,000 Plymouth 5% perpetual, a stock rarely obtainable, is on offer at 117½ to yield £4 5s.%.

Official Quotations on the London Stock Exchange

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations July 29.	Rise or Fall on Week.
1,767,439	Mar. 7	8	8	Alliance & Dublin Ord. ...	145—155	...
374,000	June 20	4	4	Do. 4 p.c. Deb. ...	93—108	...
734,733	May 9	5	5	Asscd. Gas & Water U'd'ts Ord.	17/6—19/6	...
500,000	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	19/—21/—	...
444,389	,,	§—/4	4	Do. 4 p.c. Red. Cum. Pref.	19/—20/—	...
296,523	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	16/—18/—	—1/
500,000	Mar. 7	3½	3½	Do. 3½ p.c. Red. Deb. ...	94—99	...
558,890	Feb. 21	7	7	Barnet Ord. 7 p.c.	158—163	...
300,000	Apl. 4	1/4½	1/9½	Bombay, Ltd.	24/6—26/6	...
179,915	Feb. 21	9½	9½	Bournemouth sliding scale ...	195—205	...
590,407	,,	7	7	Do. 7 p.c. max. ...	157—162	...
493,960	,,	6	6	Do. 6 p.c. Pref. ...	134—139	...
50,000	June 20	3	3	Do. 3 p.c. Deb. ...	78—83	...
262,025	,,	4	4	Do. 4 p.c. Deb. ...	98—103	+1
335,000	,,	5	5	Do. 5 p.c. Deb. ...	115—120	...
357,900	Feb. 21	7½	7½	Brighton, &c., 6 p.c. Con. ...	145—150	...
649,955	,,	6½	6½	Do. 5 p.c. Con. ...	128—133	...
205,500	,,	6	6	Do. 6 p.c. 'B' Pref.	127—132	...
855,000	Mar. 7	7	8	British Ord.	138—143	...
100,000	June 3	7	7	Do. 7 p.c. Pref.	140—145	...
350,000	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...
120,000	,,	4	4	Do. 4 p.c. Red. Deb. ...	94—99	...
450,000	,,	5	5	Do. 5 p.c. Red. Deb. ...	102—107	...
450,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	94—99	...
100,000	§22 May'33	6	4	Cape Town, Ltd.	1—2	...
100,000	6 Nov.'33	4½	4½	Do. 4½ p.c. Pref. ...	1½—3½	...
150,000	June 20	4½	4½	Do. 4½ p.c. Deb. ...	60—70	...
626,860	July 18	6	6	Cardiff Con. Ord.	118—123*	...
237,860	June 3	5	5	Do. 5 p.c. Red. Deb.	105—110	...
98,936	Mar. 21	2/—	2/—	Colombo Ord....	1⅝—1⅞	...
24,510	,,	1/4½	1/4½	Do. 7 p.c. Pref.... ...	23/—25/—	...
739,453	Mar. 21	—/11·48	—/11·48	Colonial Gas Assn. Ltd. Ord.	16/6—18/6	...
296,144	,,	1/3·30	1/3·30	Do. 8 p.c. Pref. ...	23/—25/—	...
1,775,005	Feb. 7	5	5	Commercial Ord.	81—86	...
140,000	—	—	—	Do. 4 p.c. Red. Pref.	99—102	...
620,000	June 3	3	3	Do. 3 p.c. Deb. ...	72—77	...
286,344	Feb. 7	5	5	Do. 5 p.c. Deb. ...	114—119	...
200,000	—	—	—	Do. 3½ p.c. Red. Deb.	99—102	...
807,560	Feb. 21	7	7	Croydon sliding scale ...	137—142	...
644,590	,,	5	5	Do. max. div. ...	107—112	...
620,385	June 20	5	5	Do. 5 p.c. Deb. ...	113—118	...
239,000	Feb. 7	5	5	East Hull Ord. 5 p.c.	96—101	...
185,355	Feb. 21	6	6	East Surrey Ord. 5 p.c. ...	118—123	...
176,211	June 3	5	5	Do. 5 p.c. Deb. ...	115—120	...
250,000	July 4	4	8	Gas Consolidation Ord. 'B' ...	20/—21/—	...
250,000	May 9	4	4	Do. 4 p.c. Red. Cum. Pref.	17/6—19/6	...
19,223,324	Feb. 7	5½	5½	Gas Light & Coke Ord. ...	24/—25/—a	...
2,600,000	,,	3½	3½	Do. 3½ p.c. max. ...	80—83	+½
4,477,106	,,	4	4	Do. 4 p.c. Con. Pref....	100—103	...
2,993,000	July 4	—	3½	Do. 3½ p.c. Red. Pref....	100—103	...
8,602,497	May 23	3	3	Do. 3 p.c. Con. Deb....	82—84	...
3,642,770	,,	5	5	Do. 5 p.c. Red. Deb....	111—114	...
3,500,000	,,	4½	4½	Do. 4½ p.c. Red. Deb....	109—112	...
700,000	Mar. 7	3½	3½	Do. 3½ p.c. Red. Deb....	97½—100½	...
270,466	Feb. 21	6	6	Harrogate New Cons. ...	118—123	...
157,500	Mar. 21	1/2½	1/—‡	Hong Kong and China Ord....	¾—1	...
213,200	Feb. 7	6	6	Hornsey Con. 3½ p.c. ...	100—110	...
5,600,000	May 9	8	12	Imperial Continental Cap ...	123—128	...
223,130	July 18	3½	3½	Do. 3½ p.c. Red. Deb....	87—92*	...
285,242	Feb. 21	8½	8½	Lea Bridge 5 p.c. Ord. ...	167—172	...
11,751	Feb. 21	8	10	Maidstone 5 p.c. Cap. ...	175—185	...
63,480	June 20	3	3	Do. 3 p.c. Deb.... ...	70—75	...
75,000	May 23	†10	†10	Malta & Mediterranean ...	137—142	...
392,000	Apl. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	99—102	...
231,977	Feb. 21	5	5	M.S. Utility 'C' Cons. ...	99—104	...
968,658	Feb. 21	4	4	M.S. Utility 4 p.c. Cons. Pref.	97—102	+2
360,075	June 20	4	4	Do. 4 p.c. Deb. ...	97—102	+2
148,955	,,	5	5	Do. 5 p.c. Deb. ...	113—118	...
675,000	May 9	†6	†6	Montevideo, Ltd.	73—78	+1
250,000	Mar. 7	7½	7½	North Middlesex 6 p.c. Con.	145—150	...
396,160	Feb. 7	5	5	Northampton 5 p.c. max. ...	107—112	...
300,000	Apl. 25	†9	†7	Oriental, Ltd.	147—152	...
468,537	June 3	8	8	Plymouth & Stonehouse 5 p.c.	150—155	...
621,667	Feb. 7	8½	8½	Portsmouth & Gosport Cons.	160—165	...
241,446	,,	5	5	Do. 5 p.c. max. ...	102—107	...
73,350	,,	5	5	Do. 5 p.c. Pref. ...	108—113	...
75,000	,,	—	4	Do. 4 p.c. Pref. ...	95—100	...
114,000	Feb. 7	5	5	Preston 5 p.c. Pref.	106—109	...
247,966	June 3	4	4	Primitiva 4 p.c. Cons. Deb. ...	98—103	...
625,959	July 18	4	4	Do. 4 p.c. Red. Deb. ...	94—99*	...
15,000	Mar. 21	6	6	San Paulo 6 p.c. Cum. Pref. ...	8¾—9½	...
441,275	Apl. 25	1/1½	1/1½	Severn Val. Gas Cor. Ld. Ord.	21/—22/—	...
460,810	Mar. 21	—/10½	—/10½	,, ,, 4½ p.c. Cum. Pref.	19/6—21/6	...
133,201	Feb. 7	8½	5	Shrewsbury 5 p.c. Ord. ...	128—133	...
9,000	June 3	4	‡4	South African Ord.	4½—5½	...
1,371,752	Apl. 25	1/2½	1/2½	South East'n Gas Cn. Ld. Ord.	22/—24/—	...
871,636	Mar. 7	—/10½	—/10½	Do. 4½ p.c. Red. Cum. Pref.	20/6—22/6	...
498,818	,,	4	4	Do. 4 p.c. Cum. Pref. ...	18/—20/—	...
450,000	Feb. 7	4	4	Do. 4 p.c. Deb.	100—103	...
150,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—98	...
6,709,895	Feb. 7	6	5	South Met. Ord.	106—109	...
1,135,812	,,	6	6	Do. 6 p.c. Irred. Pref. ...	130—135	...
850,000	,,	4	4	Do. 4 p.c. Irred. Pref. ...	97—100	...
1,895,445	June 20	3	3	Do. 3 p.c. Deb.	77½—80½	...
1,000,000	July 4	5	5	Do. 5 p.c. Red. Deb. ...	109—112	...
600,000	,,	—	§31/—	Do. 3¾ p.c. Red. Deb. ...	99—102	...
1,543,795	Feb. 7	6	6	South Suburban Ord. 5 p.c. ...	118—123	...
512,825	,,	5	5	Do. 5 p.c. Pref.... ...	110—115	...
500,000	,,	4	4	Do. 4 p.c. Pref.... ...	95—100	...
250,000	,,	§18/9	3¾	Do. 3¾ p.c. Red. Pref. ...	98—101	...
888,587	June 3	5	5	Do. 5 p.c. Deb.	115—120	...
250,000	,,	4	4	Do. 4 p.c. Deb.... ...	96—101	...
200,000	Mar. 1	3½	3½	Do. 3½ p.c. Red. Deb. ...	94—99	...
427,859	Apl. 25	1/2½	9½	S. Western Gas & Water Ord.	16/6—18/6	...
160,523	,,	—/10½	—/10½	Do. 4½ p.c. Red. Cum. Pf.	19/—21/—	...
110,000	June 3	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...
750,541	Feb. 7	5	5½	Southampton Ord. 5 p.c. ...	108—113	...
148,836	June 3	4	4	Do. 4 p.c. Deb.	95—100	...
350,000	Feb. 7	5½	5½	Swansea 5½ p.c. Red. Pref. ...	108—113	...
94,000	June 3	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...
1,076,490	Feb. 7	6½	6½	Tottenham and District Ord.	127—132	...
409,835	,,	5½	5½	Do. 5½ p.c. Pref. ...	119—124	...
62,235	,,	5	5	Do. 5 p.c. Pref. ...	110—115	+2
371,850	June 3	4	4	Do. 4 p.c. Deb. ...	96—101	...
85,701	Apl. 25	6	6	Tuscan 6 p.c. Red. Deb. ...	95—101	...
888,629	Apl. 4	4	6	U. Kingdom Gas Cor. Ord. ...	18/6—20/6	...
937,743	May 9	4½	4½	Do. 4½ p.c. 1st Cum. Pref.	19/6—21/6	...
500,000	,,	—/1·15	4	Do. 4 p.c. 1st Red. Cum. Pf.	19/—21/—	...
745,263	June 3	4½	4½	Do. 4½ p.c. 2nd Non-Cum.Pf.	16/—18/—	...
1,000,000	Mar. 7	3½	3½	Do. 3½ p.c. Red. Deb. ...	96—99	...
373,939	Feb. 7	7	7	Uxbridge, &c., 5 p.c.	133—138	...
133,010	,,	5	5	Do. 5 p.c. Pref. ...	110—115	+2
1,371,138	Feb. 7	7	7	Wandsworth Consolidated ...	137—142	...
2,525,768	,,	4	4	Do. 4 p.c. Pref. ...	98—101	...
1,343,964	June 3	5	5	Do. 5 p.c. Deb. ...	115—120	...
383,745	,,	4	4	Do. 4 p.c. Deb. ...	97—102	...
558,342	Feb. 7	7	7	Watford and St. Albans Ord.	135—140	...
200,000	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...
200,000	,,	5½	5½	Do. 5½ p.c. Pref. ...	120—125	...
200,000	June 3	4	4	Do. 4 p.c. Red. Deb.	96—101	...
100,000	,,	3½	3½	Do. 3½ p.c. Red. Deb.	94—99	...

a.—The quotation is per £1 of stock. * Ex. div. † Paid free of income-tax. ‡ For year. § Actual.

Supplementary List and Provincial Exchanges overleaf.

STOCK AND SHARE LIST—Cont.

Supplementary List, not Officially Quoted, London

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Nominal Quotations July 29.	Rise or Fall on Week.
202,152	Mar. 21	5	5	Ascot Ord.	103—108	...
128,182	July 18	5	5	Do. 5 p.c. Pref.	108—113*	...
31,035	Mar. 21	...	-/4½	Associated Utilities 4 p.c. Pref.	16/—18/-	...
100,000	Dec. 13	...	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...
17,000	Feb. 21	8	8	Bognor Orig. Ord. 'A' ...	155—165	...
62,210	,,	8	8	Do. New Addl. 'A' ...	155—165	...
87,160	,,	7	7	Do. New 7 p.c. max. ...	150—160	...
37,440	Feb. 7	10	10	Cam. Univ. & Town 10 p.c. max.	190—200	...
125,970	,,	7	7	Do. 7 p.c. max.	135—140	...
39,025	,,	5	5	Do. 5 p.c. max.	97—102	...
96,410	July 18	4½	4½	Cardiff 4½ p.c. Pref.	95—100*	...
150,000	Feb. 21	4	4	Croydon 4 p.c. Pref.	98—101	...
130,000	June 20	4	4	Do. 4 p.c. Deb.	97—102	...
65,000	Mar. 7	7½	8½	Eastbourne 'A' 5 p.c. ...	140—150	...
198,000	,,	6	7	Do. 'B' 3½ p.c.	115—125	...
112,312	,,	5	5	Do. 5 p.c. Pref.	107—112	...
130,000	June 20	5	5	Do. 5 p.c. Deb.	112—117	+2
24,000	Feb. 21	8½	8½	Great Yarmouth 8½ p.c. max.	43—48	...
59,400	,,	7½	7½	Do. 7½ p.c. max.	33—38	...
51,160	June 3	5½	5½	Do. 5½ p.c. Deb.	121—126	...
152,600	Feb. 21	8	9	Guildford Cons.	167—172	...
54,055	,,	5	5	Do. 5 p.c. Pref.	108—113	...
68,250	June 20	5	5	Do. 5 p.c. Deb.	107—112	...
£156,600	Feb. 21	7½	7½	Hampton Court Cons. ...	138—143	-4½
80,000	Feb. 21	4	4	Lea Bridge 4 p.c. Pref. ...	94—99	...
60,000	,,	6	6	Do. 6 p.c. Pref.	123—128	...
94,876	June 3	4	4	Do. 4 p.c. Deb.	95—100	...
73,620	Mar. 7	8½	8½	Luton Cons. 'A'	155—165	...
107,960	Mar. 21	4	5½	Mid Kent Ord.	8½—9½	...
230,940	Feb. 7	10	10	Oxford & District Ord. ...	198—203	...
47,112	,,	5	5	Do. 5 p.c. Pref.	106—111	...
50,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	108—113	...
126,193	May 9	7½	7½	Peterborough Ord.	135—145	...
64,990	Mar. 7	6½	7½	Redditch Ord.	120—130	...
166,850	Feb. 7	8	8	Romford Ord.	144—149	...
60,000	,,	4	4	Do. 4 p.c. Pref.	97—100	...
44,000	Mar. 21	5	5	Do. 5 p.c. Deb.	111—116	...
25,570	Feb. 7	5½	5½	Rugby 5½ p.c. Pref.	123—128	...
25,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	105—110	...
42,750	June 3	5½	5½	Do. 5½ p.c. Deb.	118—123	...
110,950	Feb. 21	8	8	Ryde Ord.	140—150	...
270,086	Mar. 21	7	7	Slough Ord.	128—133	...
21,000	June 20	5	5	Do. 5 p.c. Deb.	110—115	...
28,872	May 9	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	19/—21/-	...
28,866	Mar. 7	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	18/6—20/6	...
117,228	Feb. 7	5	7	Swindon Cons.	104—109	...
60,425	June 3	5	5	Do. 5 p.c. Deb.	112—117	+2
64,380	June 3	5	5	Torquay & Paignton 5 p.c. Pref.	107—112	...
130,000	Feb. 7	5	8	Wakefield Ord.	118—123	...
81,650	,,	5	5	Do. 5 p.c. max.	101—106	...
82,000	Feb. 21	6	6	Weymouth Ord.	105—110	...
98,384	Feb. 7	6	6	Wolverhampton 6 p.c. Pref.	118—123	...
160,000	June 20	5½	5½	Do. 5½ p.c. Rd. Db.	105—110	...
90,000	June 20	5	5	York 5 p.c. Red. Deb. ...	104—109	...
133,640	July 18	6½	6½	Yorktown (Cam.) 5 p.c. Cons.	118—123*	...
120,000	,,	5	5	Do. 5 p.c. Pref.	105—110*	...
35,000	June 3	5½	5½	Do. 5½ p.c. Deb.	120—125	...

BRISTOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations July 29.	Rise or Fall on Week.
347,756	July 18	6	5	Bath Cons.	118—120*	...
1,667,250	July 18	5	5	Bristol, 5 p.c. max.	111—113*	...
120,420	June 3	4	4	Do. 1st 4 p.c. Deb. ...	101—103	...
217,870	,,	4	4	Do. 2nd 4 p.c. Deb. ...	101—103	...
328,790	,,	5	5	Do. 5 p.c. Deb.	119—122	...
274,000	Feb. 21	5	5	Newport (Mon). 5 p.c. max....	99—101	...
13,200	Mar. 21	7	8½	Pontyp'l Gas & W. 10 p.c. 'A'	13—14	...
13,600	,,	5	6	Do. 7 p.c. 'B'	12—12½	...
40,000	,,	5	6	Do. 7 p.c. 'C'	12—12½	...
140,778	Feb. 7	5	5	Weston-super-Mare Cons. ...	110—112	...
64,338	June 20	4	4	Do. 4 p.c. Deb.	95—100	+3½
33,340	,,	7½	7½	Do. 7½ p.c. Deb.	151—154	...

LIVERPOOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations July 29.	Rise or Fall on Week.
157,150	Feb. 7	5	6½	Chester 5 p.c. Ord.	109—112	...
92,500	June 20	4	4	Do. 4 p.c. Pref.	95—99	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.	87—90	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	97—101	...
2,167,410	Feb. 21	6	6	Liverpool 5 p.c. Ord.... ...	124½—125½	...
245,500	June 20	5	5	Do. 5 p.c. Red. Pref. ...	97—102	...
306,083	July 18	4	4	Do. 4 p.c. Deb.... ...	100—102*	...
106,280	Feb. 7	10	10	Preston 'A' 10 p.c.	202—212	...
188,219	,,	7	7	Do. 'B' 7 p.c.	144—154	...

NEWCASTLE EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations July 29.	Rise or Fall on Week.
122,577	Feb. 21	8	8	Blyth 5 p.c. Ord.	163½—164½	...
732,000	Feb. 21	5	5	Hartlepool G. & W. Cn. & New	110—112	...
2,061,315	Feb. 7	5	5½	Newcastle & Gateshead Con.	23/3—23/9a	+/-3
682,856	,,	4	4	Do. 4 p.c. Pref. ...	100½—101½	...
776,706	June 20	3½	3½	Do. 3½ p.c. Deb. ...	88½—89½	...
277,285	May 9	5	5	Do. 5 p.c. Deb. '43 ...	104—106	...
332,351	Feb. 7	6	6	Sunderland 6 p.c. max. ...	137—139	...

NOTTINGHAM EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations July 29.	Rise or Fall on Week.
542,270	Feb. 21	6	9	Derby Con.	135—140	...
55,000	June 3	4	4	Do. 4 p.c. Deb.	100—105	...
20,000	June 20	5	5	Long Eaton 5 p.c. Pref. ...	10—12	...
80,000	,,	5	5	Do. 5 p.c. Deb. ...	105—110	...

SHEFFIELD EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations July 29.	Rise or Fall on Week.
10,000	Feb. 21	10	10	Great Grimsby 'A' Ord. ...	205—215	...
6,500	,,	10	10	Do. 'B' Ord. ...	205—215	...
79,000	,,	10	10	Do. 'C' Ord. ...	195—205	...
1,806,339	Feb. 21	6½	6½	Sheffield Cons.	140—143	...
95,000	July 4	4	4	Do. 4 p.c. Deb.	101—103	...

a The quotation is per £1 of Stock. b Actual. * Ex div.

PUBLISHERS' NOTICE

TERMS OF SUBSCRIPTION

United Kingdom & Ireland: Advance Rate, 35/- per annum; 18/- per half year. Credit Rate: 40/- per annum; 21/- per half year.
Dominions & Colonies & United States: 35/- per annum, in advance. Other countries in the Postal Union, 40/- per annum, in advance.

A copy of the "G.J." Calendar and Directory is presented to continuous subscribers.

CLASSIFIED ADVERTISEMENTS

Situations Wanted, 6d. a line (minimum 3/-, about 36 words). Situations Vacant, Plant for Sale and Wanted, Contracts, Public Notices, Educational, &c, 9d. a line (minimum 4/6). Financial Notices, 1/- per line. Box Number, 6d. extra.

WALTER KING, LTD.,

Telephone: Central 2236-7-8. 11, BOLT COURT, FLEET STREET, LONDON, E.C. 4. Telegrams: Gasking, Fleet, London.